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A New Snake of the Genus *Imantodes* from Mexico

By James A. Oliver

TWO female specimens of a snake of the genus *Imantodes* were sent to the Museum of Zoology at the University of Michigan by Mr. John T. Martin of Campeche, Mexico. A brief survey of the Central American forms of this genus suggested that these specimens represent an undescribed species. It is hoped that the description of this novelty may be preliminary to a review of the extremely interesting genus.

Imantodes **luciodorsus**, sp. nov.

Type.—No. 81920 MZUM, female; collected at Balchacaj, across the lake from Ciudad del Carmen, Campeche, Mexico; by John T. Martin, in 1937.

Paratype.—No. 81921 MZUM, female; same data and collector as type.

Diagnosis.—An *Imantodes* with 17 dorsal scale rows, the median row not or but slightly enlarged; ventrals 215–218; dorsal body bands broken on the posterior half of the body, forming three rows of dorsal spots.

Description of Type.—Maxillary teeth 8, followed by a diastema and 2 enlarged grooved fangs. Head large; eye large, with vertically elliptic pupil; rostral much broader than high, narrowly contacting internasals above; loreal slightly longer than high, contacting 2nd and 3rd upper labials; one preocular; two postoculars on the right, one on the left (the upper fused with supraocular). Internasals small, less than half size of prefrontals, broader than long; prefrontals broader than long, extending downward on side of head to below upper edge of nasal; frontal pentagonal, its length greater than distance from its anterior edge to rostral, but less than length of interparietal suture; supraocular large, not contacting prefrontals; parietal large, longer than broad; temporals 1–3; upper labials 8, 4 and 5 entering orbit; lower labials 10, 6 in contact with chin shields; chin shields approximately equal in length, but anterior pair wider than posterior.

Dorsal scales in 17 rows for nearly entire length of body, smooth, the median row not or but slightly enlarged; ventrals 218; anal plate divided; subcaudals 126. Head-body length, 454 mm.; tail length, 179 mm.

Top and side of head light cream color with small irregular spots of dark brown; a large dark brown spot in the center of each prefrontal, each supraocular, and the frontal; an elongate, somewhat crescent-shaped large dark brown mark on each parietal. Dorsal color of body light cream with 46 dark brown cross bands three to four and a half scales wide along the vertebral row, narrower on the sides, extending ventrally onto the outer edge of the ventrals. At about ventral 173 (counting from the anterior end of the body) the cross bands break up on the sides, to form three rows of dark brown spots, a dorsal row of large spots and a ventro-lateral row of smaller spots on each side. The scales between the bands on the body somewhat darker posteriorly through the presence of irregular brown stippling and spotting. Dorsal surface of tail colored like that of body, with 29 dark brown cross bands which are not broken up into rows of spots.

Underside of head light cream color; ventrals clear light cream color except for the outer edges of those involved in the dorsal bands on anterior fourth of body; round dark brown spots present on the outer portion of one to three ventrals between those involved in the dorsal bands on posterior three-fourths of body; small irregular brown flecks or spots scattered along the mid-ventral line. Brown coloration on the ventral surface increasing posteriorly, forming a dusky, irregular mid-ventral line on the under side of the tail.

NOTES ON PARATYPE.—The paratype differs from the type in having temporals 1–2; two postoculars on the left side, one on the right (the two smaller scales fusing to form a single large scale); ventrals 215; subcaudals 120. This specimen has a head-body length of 533 mm., plus tail length of 215 mm.

The coloration of the paratype is essentially like that of the type except that the dorsal bands are broken up into spots farther craniad. The bands number 43 on the body and break up at about ventral 140.

REMARKS.—The relations of this form are with *gemmistratus* and *tenuissimus*. When the latter name was recently revived (Hartweg and Oliver, 1940: 24) only differences in scutellation between the two forms were pointed out. The color pattern exhibited by these two species offers a further useful taxonomic character. In *tenuissimus* the dark dorsal bands number 43–51, average 47.0 in four specimens, and the bands *do not break up* into series of spots on the body or tail. In *gemmistratus* the dorsal bands number 48–67, average 58.6 in 14 specimens and the bands *do break up* on the body to form a series of spots.

The new species is intermediate in color pattern between *tenuissimus* and *gemmistratus*, but closer to the latter in ventral and sub-caudal scutellation. In 14 specimens of *gemmistratus* from the west coast of Mexico, 13 have the dorsal body bands breaking up into spots at ventrals 47–96, average 79; a single female from "Tehuantepec" retains the unbroken bands to a point opposite ventral 184. In the specimens of *luciodorsus* the bands break up into spots opposite ventrals 140 and 173. The ground color of these individuals is lighter than that noted for any specimen of either *gemmistratus* or *tenuissimus*, appearing almost pure white when viewed from a short distance. In respect to scutellation, the number of ventrals recorded for the two females of this form is lower than the counts observed in either of the related species, though close to those of *gemmistratus*. The subcaudal counts fall within those noted for the females of *gemmistratus*.

That the two specimens herein described represent a distinct population and are not intergrades between *gemmistratus* and *tenuissimus* is suggested by the lower number of ventrals and the lighter dorsal color.

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MUSEUM OF ZOOLOGY, UNIVERSITY OF MICHIGAN, ANN ARBOR, MICHIGAN.

A New Alligator from the Miocene of Florida

By Theodore E. White

IN the spring of 1931, Mr. Clarence Simpson of the Florida State Geological Survey discovered some fragments of bone on the dump of an abandoned well on the Raeford Thomas Farm, 15 miles west of High Springs, Florida. Later in the same year he opened a pit about 60 feet from the old well. From this pit he obtained considerable material which was studied by Dr. G. G. Simpson of the American Museum of Natural History. Pure science had to give way to economic research in the Survey, however, and the work in this area was set aside for an indefinite period. In 1938, Dr. Thomas Barbour was given permission to continue the excavations. With the aid of Mr. and Mrs. William E. Schevill he reopened the quarry the same year and obtained some excellent material. The Museum of Comparative Zoology has worked this locality each year since, and plans to continue operations as long as the returns justify the expenditures. We have enjoyed the cordial coöperation of the Florida State Geological Survey from the beginning.

Since the quarry was first opened in 1931 the Thomas Farm locality has yielded fragmentary remains of crocodilians. During the past season's work we were very fortunate in recovering a well preserved alligator skull, an excellent lower jaw of a somewhat larger individual, the posterior half of a skull of an individual of about the same size, the posterior half of the skull of a smaller individual, and a number of maxillaries, dentaries, legbones, and isolated skull and jaw elements. The fragments of the largest individuals indicate that this species attained a maximum size very nearly that of *A. mississipiensis*.

This material has been expertly prepared by Mr. Russel Olsen. In recognition of his careful work I take pleasure in naming the species for him.

Alligator ***olseni***, sp. nov.

Type.—M.C.Z. No. 1887 (Figs. 1 and 2), a well preserved skull obliquely crushed from the right side.

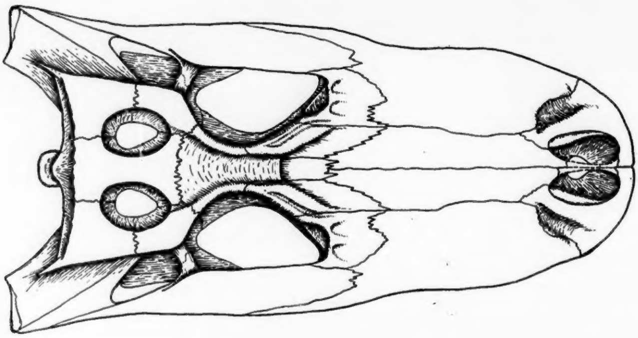
Paratype.—M.C.Z. No. 1888 (Figs. 3, 4, and 5), a left lower jaw of a larger individual.

Horizon and Locality.—Lower Miocene, Hawthorne fm.; Thomas Farm, Gilchrist Co., Florida.

Diagnosis.—Quadrate breadth only slightly exceeding one-half the greatest length; contours and proportions of the skull approaching *A. mississipiensis;* length of dental series of the lower jaw equalling one-half the total length; length of mandibular symphysis contained in jaw length nine times; splenial barely entering symphysis.

Description and Comparison.—The general form and proportions of the snout differ only in minor details from that of *A. mississipiensis.* The interorbital region agrees with *thomsoni* in that the supraorbital and anteorbital ridges are very prominent. There is also the preorbital "step" (an abrupt drop of about 3 mm. from the interorbital region to the base of the snout) which is characteristic of *thomsoni.* It also agrees with the latter in that the lateral borders of the cranial table converge forward instead of

being nearly parallel as in the recent species. The size of the supratemporal fenestra agrees better with the living species than with *thomsoni*. The relative size of the palatine vacuities is closer to that of *A. mississipiensis*.



Type, MCZ 1887

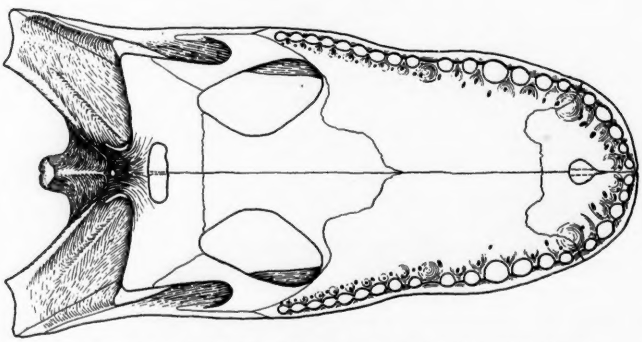


Fig. 1. Skull, M.C.Z. No. 1877. type: dorsal and ventral views.

Measurements

Skull

	olseni	*mississipiensis*	*thomsoni*[1]	*sinensis*
Number	MCZ 1887	MCZ 43005	AMNH 1736	MCZ 17550
Length	251	328	363	147
Quadrate breadth	130	153	223	83
Breadth, cranial table posteriorly	78	86	118	48
Breadth, interorbital	19	25	32	8
Breadth, base of snout	108	133	174	65
Breadth, 4th max. tooth	94	117	160	57
Breadth, max.-premax. suture	71	85	115	39

Lower Jaw

	olseni	*mississipiensis*	*thomsoni*[1]	*sinensis*
Number	MCZ 1888	MCZ 43005	AMNH 1737	MCZ 17550
Total Length	352	385	193	169
Length of symphysis	38	33	30	21
Length of tooth row	175	193	85	90

[1] Measurements were copied from the original description.

The weight and form of the lower jaw are intermediate between those characters in the jaws of *mississipiensis* and *sinensis* and are much lighter than in *thomsoni*. The curvature of the dental border resembles that of *sinensis* rather than *mississipiensis*. In the paratypic lower jaw the splenial barely enters the symphysis. In three other dentaries representing younger individuals the suture indicates that the splenial entered in one and not in the other two. The lateral fenestra agrees better with *mississipiensis* than with the other species. The splenial is elevated above the dentary along the posterior third of the tooth row more than in either of the two living species. The length of the tooth row is one-half the total length of the lower jaw. This is less than in either of the living species and more than in *thomsoni*. The length of the symphysis compared to the total length of the lower jaw is intermediate between the proportions in the two living species and less than in *thomsoni*.

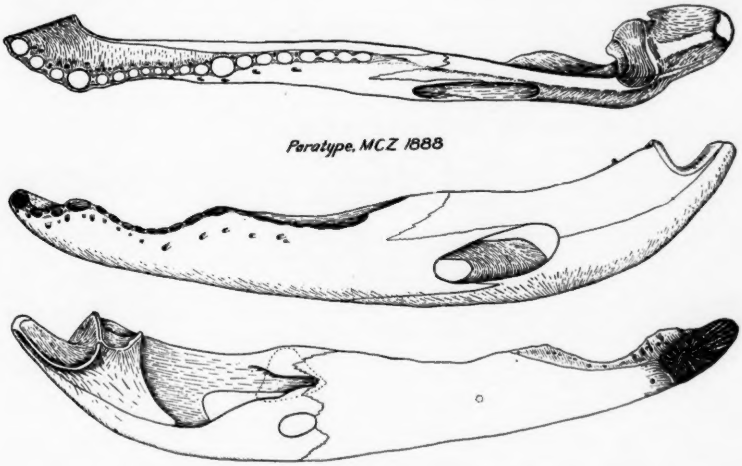


Fig. 2. Lower jaw, M.C.Z. No. 1888, paratype: occlusal, lateral, and medial views (see table of measurements for scale).

There are 5 alveolae in the premaxillary, of which the fourth is the largest, and 15 in the maxillary, of which the fourth is the largest. There is only one tooth preserved in the skull, the tenth maxillary. It is more or less conical, somewhat flattened on the medial side, and with a small carina on the front and back edges. In size and shape it is almost identical with the corresponding tooth of *A. mississipiensis* of the same skull length. Nothing can be said concerning the pit in the front of the snout to receive the first tooth of the lower jaw. The other pits for the lower teeth do not differ materially from those of *mississipiensis*.

There are 20 alveolae in the lower jaw, of which those for the first, fourth, and thirteenth teeth are much larger than the others. Of these the fourth is the largest. Back of the fourth tooth only the thirteenth tooth is greatly enlarged in this form, in *mississipiensis* the thirteenth and fourteenth,

in *sinensis* the twelfth and thirteenth, and in *thomsoni* the twelfth only.

There is, I think, small reason to doubt that the external nares were divided in this form. While the septum is not preserved there is ample evidence that the premaxillary and nasal processes have been broken off, rather than that they never existed.

DISCUSSION.—From the foregoing comparisons it is clear that the affinities of this form are closer to *mississipiensis* than to *sinensis* or *thomsoni.* It would appear that the middle Tertiary alligators were divided into two series; a northern short-snouted one represented by *thomsoni,* and a southern long-snouted one represented by *olseni.* It seems highly probable that *mississipiensis* evolved "in situ" and that *sinensis* descended from some species of the northern phylum which spread into Asia. Mook (1923 and 1932) has indicated *thomsoni* as the probable ancestor of *sinensis.* It is certainly the closest approach yet known. However there is greater difference between *thomsoni* and *sinensis* than there is between *olseni* and *mississipiensis.* Unfortunately the paleontological record does not throw any light upon the date of the invasion of Asia by the northern stock.

An examination of specimens of *Allognathosuchus heterodon* (Cope) and *Caimanoidea prenasalis* (Loomis) in the Museum of Comparative Zoology indicates that the obliteration of the supra-orbital and anteorbital ridges in these forms is to be correlated with the greater depth of the pits on the dorsal surface of the skulls. The greater depth of the pits seems to have been brought about by increasing the height of the intervening septa rather than by incision of the pits deeper into the bone. Consequently, one of the changes necessary to derive the recent alligators from the early tertiary forms is a partial arrest of the physiological processes which built up the septa between these pits.

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MUSEUM OF COMPARATIVE ZOOLOGY, CAMBRIDGE, MASSACHUSETTS.

Notes on Philippine Sea-Snakes

By ALBERT W. C. T. HERRE

THE sea-snakes, a special family, the Hydrophidae, are a small group, specialized for marine life by having the short tail vertically flattened and paddle-shaped. Poison fangs are always present, and some of the species are among the most venomous of all snakes. They are most abundant in the Indian and western Pacific Oceans, and from the Riu Kiu Islands to tropical Australia. One species, *Pelamis platurus*, ranges eastward to the coast of tropical America and to Madagascar in the opposite direction. Another, *Hydrophis semperi*, is found only in a Philippine fresh water lake, Lake Bombon, often mistakenly called Lake Taal from the volcano on an island in the lake.

These snakes occur not only along shore, but often far from land. Malcolm Smith, in his monograph on the sea-snake group, says that with the exception of *Pelamis* "they are never met with far from the coast," and that "river mouths are particularly favored by them." I have, however, seen various species of sea-snakes 100 to 150 miles from land.

Sea-snakes feed exclusively on fishes, any available kind being eaten if small enough. The species of *Hydrophis* and *Laticauda* feed largely, if not entirely, on small eels. Some species of *Hydrophis* have a very small head and a long slender neck-like region, which is only one-half or even one-fourth as deep as the posterior part of the body. This peculiar shape causes them to feed almost exclusively on small eels of the families Ophichthyidae or

snake eels, Myridae, and the Moringuidae or worm eels. On several occasions I have obtained rare and little known eels from the stomachs of sea-snakes. It is equally evident that the shape of sea-snakes fits them to be the food of voracious marine eels. Many times I have taken sea-snakes from the stomachs of large morays.

I believe that the principal factor governing the distribution of sea-snakes is the depth of water. This is particularly true of the more highly specialized species of *Hydrophis*. I do not know to what depth sea-snakes are able to go, but believe that ordinarily most species must remain in water shallow enough for them to go to the bottom and capture eels. In the sea north of Bohol, where the water is exceedingly clear, one may see many sea-snakes come up from the depths and swim to the surface. After taking breath, they slowly swim downward again, until they disappear. According to the hydrographic chart, the water there is from 150 to about 500 feet deep, and evidently the sea-snakes go to the bottom to hunt food. It is probable that they are confined largely to waters within the 100 fathom depth line. Wide seas too deep for sea-snakes to feed on the bottom are a barrier to many species, and such barriers have effectively separated most Asiatic and Australian species.

Sea-snakes are not strictly diurnal as some authors suppose. I have seen and captured many at night, as well as in the daytime. While hundreds may sometimes be seen floating at the surface, in the full glare of the sun, certain species seem to avoid the sun and spend most, if not all, of the day hidden in rock crevices or among the exposed root masses of *Barringtonia asiatica*, a large tree occurring on sea-beaches from Ceylon to Polynesia. If one will search carefully at low tide in the crevices of piers built of coral heads, or the matted roots of *Barringtonia*, in the Philippines or East Indies, he may find sea-snakes in abundance. In a quarter of an hour one afternoon I secured 15 specimens of *Laticauda colubrina* from *Barringtonia* roots at Pulau Salo, a tiny isle 12 miles from the Singapore water front. This species seems to be most active in the late afternoon or at night or on dull clouded days.

Not much is known positively about the effects of the venom of most sea-snakes. In spite of their abundance not many people are bitten by them. Sea-snakes try to escape when disturbed, and in general are gentle and slow to bite. They are often caught in fishermen's nets, and sometimes more than a hundred may be taken at a single haul of a beach seine in Manila Bay. The fishermen of Manila Bay often haul many dozen into their canoe, when pulling in a net. Without hesitation they snatch them up and toss them overboard. Elsewhere Philippine fishermen seem to fear sea-snakes greatly, and always use a fish spear or long-handled paddle in handling them. In most places one hears tales of deaths from the bites of sea-snakes. *Laticauda semifasciata*, bulkiest of Philippine sea-snakes, is handled very freely by Japanese fishermen who come from the Riu Kiu Islands. Specimens from one to two meters long are eagerly caught for food, and any not eaten at once are kept alive in large earthen jars until needed. One may see a Japanese thrust his hand into a jar and pull out a huge specimen with no more concern than if it were a piece of rope. However no one, not even a Manila Bay or Japanese fisherman, ventures to handle freely a specimen of *Hydrophis cyanocinctus* 8 or 9 feet long.

I once placed a living eel, of the genus *Ophicthus,* perhaps a foot or so in length, in a tank of sea-snakes in the Manila Aquarium. As it swam downward it passed a specimen of *Lapemis hardwickii,* which bit the eel near its middle. The eel straightened out, stiffened, and was dead in an almost unbelievably short time.

Some species of sea-snakes resort to uninhabited coral or rocky isles to bring forth their young. Some species, particularly of *Laticauda,* are able to leave the water and clamber up rocks, often to a height of 20 feet or more. Even species that are almost helpless on land are able to get out of the water with ease at high tide. One may see them suddenly emerge upon the middle of some coral islet. Evidently they swim along through the water-filled passages, until they reach an opening and are laid upon its margin by the rising tide.

On some coral islets, with vertical sides and a flat surface 3 or 4 meters above mean tide, one may see hundreds of sea snakes. Such places are very dangerous to barefoot persons, as it is difficult to avoid stepping on the snakes, which are unusually active and inclined to be aggressive during the breeding season. All the sea-snakes I have collected from such places have belonged to two species, *Hydrophis cyanocinctus,* and *Laticauda colubrina.* Some of the first-named species were over 8 feet in length. Such large, active and angry snakes could only be handled by holding them firmly immediately behind the head. To attempt to hold one by the tail would be fatal. My Filipino helpers would only handle them with a noose on the end of a bamboo.

I have taken the following species in Philippine waters:—

Laticauda laticaudata (Linnaeus).
Laticauda colubrina (Schneider): common in harbors, bays, and on rocky shores.
Laticauda semifasciata (Reinwardt): common on outlying reefs and rocks exposed to the open sea.
Hydrophis inornatus (Gray): common in Manila Bay.
Hydrophis belcheri (Gray).
Hydrophis cyanocinctus Daudin: common in bays and on rocky isles.
Hydrophis fasciatus atriceps (Günther): not rare in Manila Bay.
Hydrophis semperi Garman: common in Lake Bombon.
Lapemis hardwickii Gray: abundant in Manila Bay, and occurring generally in the Islands.
Pelamis platurus (Linnaeus): generally distributed, but not taken as often as some species.

I have failed to obtain two other species recorded from the Philippines. *Aipysurus eydouxi* (Gray) is said by Boulenger to occur there, but he lists no specimen, and other authors have merely copied his statement. Neither E. H. Taylor nor I have seen any Philippine specimens. The occurrence of *Hydrophis spiralis* (Shaw) in the Philippines is also doubtful. Malcolm Smith lists it from a specimen from the Zoological Museum of Berlin, labelled Mergusi, Philippine Islands. I have been unable to find any such place as Mergusi in these Islands, and believe the specimen probably came from some other part of the East Indies.

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Stanford University, California.

A Collection of Amphibians and Reptiles from Western Montana

By Thomas L. Rodgers and William L. Jellison

THESE notes are based upon a collection of amphibians and reptiles made chiefly in the Bitterroot Valley of western Montana by the junior author and some of his associates of the Rocky Mountain Laboratory of the United States Public Health Service at Hamilton, Montana. The specimens have been identified by the senior author at the Museum of Vertebrate Zoology, University of California.

The Bitterroot Valley is of interest to the zoogeographer because it lies near the boundaries of several distinct faunal regions. It is bounded on the east by the Sapphire Range, on the south by the Continental Divide, and on the west by the high Bitterroot Mountains. The head of the valley is one of the low passes (7000 feet) on the Continental Divide and the drainage is part of the Columbia River system. It might therefore be expected that the fauna would include Great Plains elements that have "spilled over" the low passes in the Continental Divide, and western elements either of the Great Basin or of the Columbia River drainage system. This expectation is realized, since some members of the reptile and amphibian fauna are the westernmost representatives of Great Plains species and some are the easternmost representatives of western species. The relationships with the western forms seem to be largely through the Columbia River drainage system.

All specimens not otherwise accredited were collected by W. L. Jellison, and all have been deposited in the Museum of Vertebrate Zoology.

List of Species

Ambystoma macrodactylum Baird.—Long-toed salamanders were collected on June 4, 1932, August 14, 1934, and in October, 1939. Their occurrence in Ravalli County is not surprising since their range is described in the *North American Checklist* as including Montana and Iowa. These specmens do not seem to differ from specimens from the Pacific coast.

Ascaphus truei Stejneger.—One bell toad was collected at Camas Lake, Ravalli County, on July 22, 1932. This is the third known locality for this toad in the Rocky Mountains. The other two are Glacier National Park, 170 miles north of Camas Lake, and Haugen, Mineral County, 100 miles northwest.

Bufo boreas boreas (Baird and Girard).—One northwestern toad was collected by Linsdale and Jellison at Hamilton on October 9, 1939. This specimen does not have the black speckling on the ventral surfaces that is common on *B. b. boreas* of Washington and which usually is described as typical of the race. In color it resembles specimens of the same race from British Columbia and Washington more than those from Wyoming and Utah. Toads are common in the region, especially around the warmer lakes in spring.

Hyla regilla Baird and Girard.—Pacific tree-toads collected in the Bitterroot Valley extend the known range of the species slightly and add it to the known fauna of Montana. None of the thirty-one specimens from the vicinity of Lake Como has a color pattern that approaches the uniform bold pattern of the *Hyla regilla* from the Great Basin. Most of them more nearly resemble

specimens from Washington, Oregon and California. This evidence tends to confirm what might be expected, namely, that the population of the Bitterroot Valley is related to that of the Pacific coast through past or present connection along the Columbia River drainage. Fifteen of the specimens have a color pattern that seems to be peculiar to the Bitterroot Valley in that it is broken up into many small units. One specimen, the most extreme in this respect, has 88 small dark gray spots of irregular shape on the back. The heavy Y-shaped mark between the eyes that is so characteristic of *Hyla regilla* is represented on some of these specimens only by a narrow branched line. The markings on the legs are also broken into many more small units than is typical for the species. Since there were more than a thousand specimens in the collection from the Pacific coast area with which our specimens were compared, it seems reasonable to assume that all of the major color patterns that might appear in individuals from the Pacific coast were represented, and from this it might follow that the population around Lake Como is unique in having this finely speckled color phase.

Rana pretiosa pretiosa (Baird and Girard).—Two western spotted frogs were collected at Stony Lake, Granite County, July 17, 1932, and one at Lake Como, Ravalli County, October 12, 1939. This is a race of the Pacific northwest which occurs in the Rocky Mountains in Montana and Wyoming. It is most abundant in the higher mountain lakes.

Gerrhonotus coeruleus principis (Baird and Girard).—Four northern alligator lizards were collected in Ravalli County, as follows: East Fork, September, 1932, by John Dowling; Bear Creek, September, 1932, by B. Thrailkill; Goat Mountain, June 21, 1931; and an unnamed locality, September 1, 1938, by Jellison. These records, combined with the records of Slipp (1940: 35) in Bonner County, Idaho, help to explain the occurrence of the species at Rock Creek, Park County, Montana, as mentioned by Fitch (1938: 406). The range of the species evidently extends up the Columbia River drainage system through the Clark Fork and Bitterroot River valleys and "spills over" the divide as far as Rock Creek. It is rarely seen in the Bitterroot Valley. A record from Latah County, Idaho, shows that the species also ranges from the Columbia River up the Snake River valley.

Eumeces skiltonianus skiltonianus (Baird and Girard).—One specimen from Ravalli County—the first record for Montana. The species is rarely seen in the region.

Charina bottae (Blainville).—A rubber snake was collected in Skalkaho Canyon, Ravalli County, in July, 1939, by Edwin Milburn; in addition one was taken in Sleeping Child Canyon, and one near Camas Creek in the same county. East of the Continental Divide this species has been reported only from Cody, Bighorn County, Wyoming, and Chico, Park County, Montana (Van Denburgh, 1922: 643).

Coluber constrictor mormon (Baird and Girard).—Two yellow-bellied racers, one collected in Skalkaho Canyon and one 8 miles south of Hamilton, prove to belong to this race. Specimens from central Montana seem to indicate that intergradation with *flaviventris* takes place east of the Continental Divide.

Pituophis sayi sayi (Schlegel).—The range of *Pituophis sayi sayi*, according to Stull (1940: 132), does not extend west of the crest of the Rocky Mountains

in Montana. However, she records data (p. 121) for a specimen from Hot Springs, Sanders County, in the Flathead River Valley. Our four specimens from Ravalli County make a total of five from this area, just over the crest of the Rocky Mountains from the range of *P. sayi sayi* as formerly known. Dr. Norman E. Hartweg has called our attention to the fact that one of our specimens (MVZ No. 32625), seen by him, is somewhat darker, both dorsally and ventrally, than specimens from eastern Montana and Wyoming. He notes further that the light spaces between the anterior dorsal blotches are widest on the mid-dorsal line and that each has a black area in its center. Bull snakes from eastern Montana are not thus marked, though some show a tendency toward this condition. This specimen has only two prefrontals, an extremely unusual condition in *Pituophis sayi* though typical in the Mexican *deppei*. The three specimens subsequently taken are all more nearly typical of *sayi*. Data from our four specimens follow:

Specimen	32625	33078	33878	33879
Locality	Skalkaho Canyon	Woodside	near Darby	near Darby
Sex	♂	♂	♂	♀
Scale rows	27–30–23	27–29–23	28–30–23	27–29–22
Ventrals	214	217	222	221
Caudals	59	58	63	53
Ventrals + caudals	273	275	285	274
Supralabials	8	8	9/8	8
Infralabials	11	11/12	12	12
Preoculars	1	1	2/3	1
Postoculars	3	3	3/4	3/4
Dorsal blotches:				
Body	46	54	59	48
Tail	11	13	16	14
Total	57	67	75	62
Total length (mm.)	115/0	103/0	96/6	92/0
Tail/total length	.141	.134	.146	.136

Although these specimens are most like *P. sayi*, they approach *P. catenifer* in some respects, and are more like *P. c. catenifer* than *P. c. deserticola*.

Thamnophis ordinoides vagrans (Baird and Girard).—The wandering garter snake has been collected at Skalkaho Canyon by C. B. Philip, at Mill Creek by B. Thrailkill, and at Hamilton, Bitterroot River, and at an unnamed locality, all in Ravalli County, in the months of April, May, June, and August. Although this is primarily a species of the Great Basin and Pacific northwest, it has been collected in many places on the eastern slopes of the Rocky Mountains.

Thamnophis sirtalis parietalis (Say).—Three specimens from Lake Como, Ravalli County, add one more to the few already known localities of this form west of the Rocky Mountains and help to outline the western limits of its range. Both this species and *Thamnophis vagrans* are common.

Crotalus viridis viridis Rafinesque.—Two prairie rattlesnakes were collected in Ravalli County, one at Medicine Springs on July 10, 1932, and one at Sleeping Child Canyon on August 5, 1940. One contained a freshly eaten ground squirrel, *Citellus columbianus*, measuring 11¾ inches long and weighing 297 grams. The snake measured 39 inches long and weighed 414 grams after removal of the squirrel. Rattlesnakes are common on the hills east of the Bitterroot River in Ravalli County from Skalkaho Canyon to Sula. Hiberna-

tion dens are known near Skalkaho Canyon, Harlan Gulch, and Deer Mountain. This Great Plains race is also known to occur west of the Continental Divide in the Lemhi Valley of eastern Idaho (Klauber, 1936: 241).

Chrysemys bellii bellii (Gray).—Only one specimen of the western painted turtle is in this collection, although it is known to occur commonly in the Bitterroot Valley.

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A Neglected Species of *Coluber*

By Stanley Muliak and Dorothea Muliak

Cope described two racers from south Texas and adjacent Mexico in 1895, *Zamenis stejnegerianus* from Brownsville, Texas, and *Zamenis conirostris* from Matamoras, Tamaulipas, and redescribed both species in 1900 (p. 797–798) without comment. Ortenburger (1928: 178) synonymized these two species with *Coluber constrictor flaviventris*. Ortenburger's most southerly records for *flaviventris* are Galveston and Kinney County, Texas, and his map of the distribution shows no records south of the 29th degree of latitude. Cope's two specimens from Brownsville and Matamoras are from below the 26th parallel. The synonymizing of these forms seems to have been a conservative action prompted by a lack of additional material.

During seven years residence in the Lower Rio Grande Valley in Texas, in the Brownsville region, about twenty-five specimens of a *Coluber* approximating Cope's descriptions have been observed in captivity, and about half that number preserved. In the field, they are largely arboreal, gliding easily through the tops of bushes. When approached, they often remain quiet among the branches, relying on their coloration to help them escape notice.

The differences on which Cope created two species from two specimens are not significant when a series is examined. The south Texas form, however,

has few points of similarity with *C. c. flaviventris* when the new data are analyzed. It does have much in comon with the *constrictor* group, and it is here regarded as a subspecies, *Coluber constrictor stejnegerianus* (Cope).

Color Description.—In adults the color above is Ivy Green; the head is Brunswick Green or lighter; the belly is yellow to yellow-green (Certosa). The throat is Peach Blow. The sides are usually much lighter than the dorsum, and in some specimens this difference is so pronounced as to suggest a broad dorsal stripe. No spots or other markings occur.

In the juveniles there is only a superficial resemblance to the other young of the *constrictor* group. There are no saddles, the dark markings above being of small spots considerably scattered. Only on the anterior part of the body is there a suggestion of narrow crossbars about one and a half scales wide formed by the fusion of the small spots. There are about 48 such bars on the anterior half of the body. The head above is dark olive; the upper labials are yellow with a dark posterior border on most of the scales. About two thirds of the lateral scales of the anterior half of the body have many irregularly scattered dots about a half scale in size. Posteriorly the body becomes uniformly dark olive green. The underside is yellow, the ventrals anteriorly with small spots near their lateral borders, unspotted posteriorly. The dorsal scales are very finely striated longitudinally with about 50 striae per scale. One young specimen (680 mm. long) was secured on March 18, 1935; its dorsal coloration was that typical of adults; ventrals ivory except under neck and chin which was more yellowish; a few juvenile markings visible on the upper labials. After shedding on May 27, this specimen was colored much as are larger adults.

Scale rows 17–15, the reduction taking place by loss of the 4th row just anterior to the middle of the body. Ventrals 158 to 166; average 160; caudals 79 to 105, average about 93. Chin shields narrow, subequal, or one pair noticeably longer or shorter than the other. Upper labials 8–8, rarely 8–7, by loss of the third labial on one side. Infralabials 8–8, occasionally 8–9, the fifth largest. Preoculars 2–2, lower very small; postoculars 2–2; temporals 2–2–2, additional small scales often present, making four in a row; sometimes the first two temporals fused. A single loreal, rectangular, longer than high; additional much smaller loreals may be formed by the splitting of the posterior portion. Anal plate divided. Rostral wider than high, about 5 to 3.

Body slender, length rarely reaching to 950 mm. Head gently convex, slender, but little wider than the neck, the widest part across the middle of parietals. Front view shows head almost square. Ratio of width of head divided by length about .46. Tail about .26 of total length. Rear part of frontal as wide as supraocular at that point, or nearly so; sides of frontal concave to straight, its anterior corners occasionally touching upper preocular.

The dentition consists of 19 maxillary teeth; 18 dentary teeth; 13 palatine teeth, and 25 pterygoid teeth.

Remarks.—It is obvious that the racers of the *constrictor* group are closely related. Additional material of *stejnegerianus* from other areas is needed to get a better understanding of its relations. *Coluber constrictor stejnegerianus* and *C. c. mormon* have eight upper labials, and they are similar in color and size. The maxillary teeth of *stejnegerianus* are more numerous than in the other subspecies as defined by Ortenburger; the pterygoid teeth approximate those of *constrictor;* the dentary and palatine teeth are more

numerous than in *mormon* but approximate the number in *flaviventris* and *constrictor*. The Brownsville species has the narrowest supraocular in relation to the width of the rear of the frontal. In it the loreal borders on the second and the anterior half of the third labials, while in *flaviventris* and *constrictor* it borders on the third and fourth.

Specimens examined in various detail are in the collections of Mr. Bryce C. Brown of Harlingen, Texas, several in the Museum of the Chicago Academy of Science, several deposited by Dr. J. H. Swanson in 1932 in the Edinburg College collection, and the following, taken near Edinburg, in the authors' collection: SM 10, SM 96, SM 820, SM 821, and SM 822.

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A Distributional Check-List of the Reptiles of Washington

By Murray L. Johnson

THIS list of the reptiles of the state of Washington is derived from a more comprehensive paper prepared at the College of Puget Sound, based on many years of field collecting, examination of the literature, and study of the collections of museums throughout the country. This has necessitated reestablishment of some subspecific categories. Locality records have been checked and ranges defined more accurately. The Cascade Mountains, running north and south, prove to be the prime factor separating faunal areas. The names in Stejneger and Barbour's *Check List* (1937) have been followed except as more recent work establishes changes. This paper serves to verify and add somewhat to Owen's *A List of the Reptiles of Washington* (1940: 169).

List of Species

Uta stansburiana stansburiana Baird and Girard.—Previous Washington records of this wide ranging species are few, but it proves to be common, with a general distribution over the lower altitudes east of the Cascade Mountains. There is great cyclic variation in numbers from year to year in given localities.

Sceloporus graciosus gracilis Baird and Girard.—Common in many sand dune regions; found only east of the Cascades.

Sceloporus occidentalis occidentalis Baird and Girard.—This subspecies is found both east and west of the Cascade Mountains, and is very common in many places. Specimens from extreme southeastern Washington do not seem

to be *Sceloporus occidentalis biseriatus* Hallowell, and I therefore conclude that *biseriatus* is not found in Washington.

Phrynosoma orbiculare douglassi (Bell).—Found only in the dry country east of the Cascade Mountains; generally distributed.

Phrynosoma platyrhinos platyrhinos Girard.—Only two specimens appear to be recorded from this state, collected many years ago at Fort Walla Walla, in southeastern Washington. Klauber (1939) is followed for the nomenclature of these species of *Phrynosoma*.

Gerrhonotus coeruleus principis (Baird and Girard).—A common inhabitant of western Washington, found sparingly in the wooded portions of the state east of the Cascades, in Chelan, Kittitas, and Okanagan counties.

Gerrhonotus multicarinatus scincicauda (Skilton).—This species has a very limited range in Washington, known only from specimens from Klickitat County at the extreme southern border, just east of the Cascade Mountains.

Eumeces skiltonian skiltonianus (Baird and Girard).—Previous records from Washington are few; I have found this subspecies to be fairly common in several localities east of the Cascade range. There are no records from western Washington.

Charina bottae (Blainville).—Found over the entire state in suitable wooded areas, but not common.

Diadophis amabilis occidentalis Blanchard.—Three specimens have recently been reported by Svihla, two from Whitman County, to the east, and one from along the Columbia River in Cowlitz County (Svihla, 1938).

Coluber constrictor mormon Baird and Girard.—Common east of the Cascade Mountains and occasionally collected in the Puget Sound prairie country.

Coluber taeniatus taeniatus (Hallowell).—A specimen collected May, 1941, from Ginkgo Petrified Forest State Park, Kittitas County, is recorded by Slater (1941: 74). This extends the range several hundred miles, from southern Idaho and Oregon (Harney County). This species may be supposed to be a rare resident of eastern Washington.

Pituophis catenifer catenifer (Blainville).—This subspecies, found west of the Cascades, is known in this state only from several specimens collected in the Puget Sound region at an early date. Specimens from east of the Cascade Mountains are *Pituophis catenifer deserticola*. The respective ranges of these forms extend into this state from Oregon.

Pituophis catenifer deserticola Stejneger.—Common in most areas east of the Cascade Mountains.

Lampropeltis multicincta (Yarrow).—Reported from a specimen from Klickitat County, along the Columbia River. This colorful snake is known to residents of Klickitat County, and appears to be known also in the Blue Mountains of southeastern Washington.

Contia tenuis (Baird and Girard).—An extremely rare inhabitant of Washington, there being only two known specimens, one an early record and one more recently obtained. Both are from the Puget Sound region of western Washington.

Thamnophis ordinoides ordinoides (Baird and Girard).—The most abundant snake in the western part of the state. It does not occur east of the Cascade Mountains.

Thamnophis ordinoides vagrans (Baird and Girard).—Found both east and west of the Cascades. I agree with Fitch (1940: 16) in discounting the differentiation of the Puget Sound area specimens, which exhibit a certain proportion of divided preoculars.

Thamnophis sirtalis pickeringii (Baird and Girard).—Strictly a subspecies of western Washington, confined to the Puget Sound country. Fitch has independently arrived at the conclusion that *pickeringii* is a recognizable race.

Thamnophis sirtalis concinnus (Hallowell).—This subspecies has been taken in a limited area in western Washington along the Columbia River in Clark County, and has been observed in Wahkiakum County. Proper definition of the subspecies necessitates reidentification of most of *Thamnophis sirtalis* from Washington, since Ruthven (1908) and other writers, working with insufficient series, failed to recognize the diverse populations allied to *sirtalis* in the Pacific Northwest. These may be distinguished as follows:

A. No red in coloration; irregular narrow dorsal and lateral lines (greenish blue in live specimens) .... *Thamnophis sirtalis pickeringii*

AA. Red lateral bars; regular dorsal stripe on one and two half rows of scales (yellow in live specimens).

B. No lateral lines, or a broken series of lighter markings in the position of the lateral lines; general coloration darker .... *Thamnophis sirtalis concinnus*

BB. Always a regular lateral line; general coloration brighter .... *Thamnophis sirtalis tetrataenia*

Thamnophis sirtalis tetrataenia (Cope).—Found both east and west of the Cascade range within the state except in the limited area occupied by *Thamnophis sirtalis concinnus*, and in the lowlands of the Puget Sound region occupied by *Thamnophis sirtalis pickeringii* though there is definite overlap. This is the opinion of Fitch, whom I wish to thank for his advice on this form. Comparison with series of *Thamnophis sirtalis parietalis* (Say) from the region of the type locality of that form reveals significant differences.

Hypsiglena ochrorhynchus Cope.—Known in Washington from a specimen from Grant County (Svihla and Knox, 1940). Anderson has recently secured two specimens from Oregon and this species must be considered a rare resident of Washington, east of the Cascades.

Crotalus viridis oreganus Holbrook.— Found throughout the part of Washington east of the Cascade Mountains, but much less common in recent years with the encroachment of civilization.

Clemmys marmorata (Baird and Girard).—Found only west of the Cascade Mountains and now rare.

Chrysemys bellii bellii (Gray).—A colorful resident of the eastern part of the state, found in limited numbers along the Columbia River in western Washington.

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Evidence for the Separation of the Crotalid Genera *Trimeresurus* and *Bothrops*, with a Key to the Genus *Trimeresurus*

By T. PAUL MASLIN

IN recent years there has been a growing tendency to combine the crotalid genera *Bothrops* and *Trimeresurus*, though a few herpetologists have retained them as separate groups, primarily on the grounds of convenience. Amaral (1926: 35) in his review of the nomenclature of these groups retains the two names not only because of the geographic isolation of these snakes but also because they could not conclusively be shown to be identical. Barbour (1940: 217) retains the two genera on different grounds. In addition to the obvious convenience of separate generic names, he points out that the combined ranges of the two groups do not suggest a monophyletic origin.

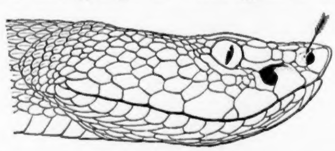

Fig. 1. Head of *Trimeresurus mucrosquamatus*, showing position of nasal pore.

Recently, while examining some specimens of *Trimeresurus* from China, I noticed a small pit within the nostril. This pit is a minute pore lying on the inner posterior wall of the nostril and is not connected by a groove with the main nasal cavity. With the thought that this might prove to be an important generic character, other oriental species were investigated. The pore was found to be present in all but two of the Asiatic species examined, but it varies considerably in shape and size, as can be seen in the accompanying figure.

The two Asiatic species lacking this pore, *wagleri* (Boie) and *philippinensis* Gray, differ from the rest of the Asiatic pit vipers in a number of other characters. This additional evidence so conclusively isolates them morphologically that I do not feel they should be included in the restricted genus *Trimeresurus*. Either they constitute a distinct genus or they are congeneric with some American group. The condition of their pterygoid teeth and their normal subcaudal scutellation precludes placing them in *Lachesis;* but they do possess a number of characters that ally them to the American species, the more important of which are as follows:

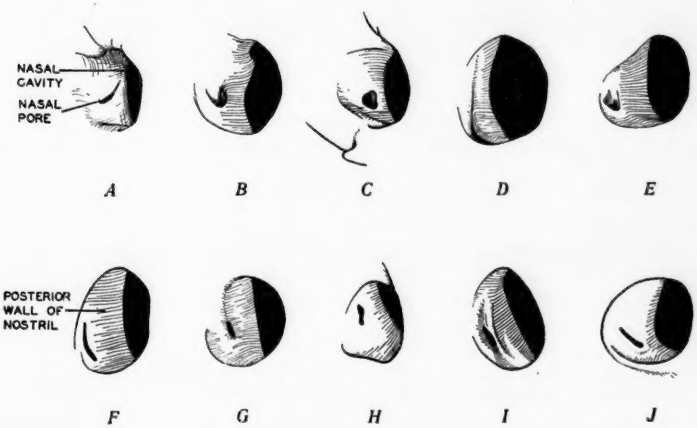

Fig. 2. Right nostril of ten species of *Trimeresurus*, showing the variation of shape and position of the nasal pore. Magnification approximately 5. A, *T. okinavensis*, CAS 21933, Okinawa Shima, Ryukyu I. B, *T. mucrosquamatus*, MVZ 22325 ♂, Lushan, Kiangsi, China. C, *T. jerdonii*, FMNH 15147, ♀, Szechwan, China. D. *T. gramineus*, CAS 17272 ♀, Northern Circars, India. E, *T. s. stejnegeri*, MVZ 23923 ♂, Ta Han, 750 m., Hainan. F, *T. puniceus*, USNM 44116 ♂, Mt. Salak, Goenoeing, Java. G, *T. trigonocephalus*, CAS 17275 ♂, Ceylon. H, *T. erythrurus*, AMNH 2158 ♀, Maylaysia or E. Indies. I. *T. sumatranus*, AMNH 2892 ♂, Sumatra. J, *T. albolabris*, AMNH 27922 ♂, Nodoa, Hainan.

1. The nasal pore does not occur in the following species of *Bothrops* (as distinguished from *Trimeresurus*): *lateralis, schlegelii, atrox, nummifera, godmani, aurifera,* and *nigricauda;* but does occur in *castelnaudi.*

2. The head scales of *wagleri* and *philippinensis* are strongly keeled. This is a prominent character of most species of *Bothrops,* but is found in in no Asiatic species. This condition is most closely approached in *Trimeresurus acutimentalis* Werner of the *purpureomaculatus* group. Here, according to Werner (1926: 257), the interoculars and the posterior head scales are keeled. From his failure to mention the condition of the anterior head scales I presume they must have been smooth, as are the head scales of the rest of the *purpureomaculatus* group.

3. The extreme breadth of the head and the small triangular snout of

wagleri and *philippinensis* are common in *Bothrops* but do not occur in *Trimeresurus.*

4. Smith's (1931) work on the venom of *wagleri* indicates that it is neurotoxic. This type of venom is found in several species of *Bothrops,* whereas the venom of other Oriental pit vipers is, to the best of my knowledge, haematoxic.

5. The hemipenis of *wagleri* is spinous to its extreme tip and lacks calyces. This is a common type among the species of *Bothrops* but does not occur in *Trimeresurus.* The hemipenis in the latter group is frequently spined or papillated, but it always has a calyculate area of considerable extent at the tip.

A few other characters in *wagleri* and *philippinensis* corroborate the relation with American pit-vipers, but they are present in some Oriental species as well, although in species recognizably primitive. In neither *wagleri* nor *philippinensis* does the second labial scale border the pit, and, further, in both these species, a lacrimal scale occurs between the subfovial scale and the orbit. The nature of the venom of *philippinensis* has not been established nor has the hemipenis been examined, but it is so clearly related to *wagleri* as demonstrated by other characters that I do not hesitate in placing both species in the genus *Bothrops.*

With these two forms so separated, the rest of the Asiatic species form an extremely coherent group, to which I propose the name *Trimeresurus* Lacépède be restricted. The genus may be redefined as follows:

Trimeresurus Lacépède

Lacépède, Ann. Mus. d'Hist. Nat. Paris, 41, 1904: 209. Type *Trimeresurus viridis* (Bechstein) = *Trimeresurus gramineus* (Shaw).

A genus of crotalid snakes in which the forks of the hemipenis are similar and of equal length; hemipenial tips flounced or calyculate; spines present or absent proximally; sulcus spermaticus bifurcate, extending to tips or near tips of each fork of organ. Pterygoid teeth extending posteriorly beyond the ectopterygoid articulation; pterygoid and mandibular teeth scaphiodont; palatine teeth isodont, numbering 2 to 6 (absent in *T. jerdonii*). Nasal pore present in posterior wall of nostril; nasals in contact with or fused to first labial, in contact with second labial, which usually borders the loreal pit; third labial largest (except in *T. chaseni*); subocular scale or scales present, in contact with the labials or separated from them by one to three rows of scales. Upper head scales small and numerous (except in *macrolepis*), usually smooth, always smooth anterior to the eyes. Body scales smooth or keeled, in 12 to 39 rows at midbody; without apical pits (indications of pits occur in the anterior scales of some species). Anal plate single; subcaudals paired (occasionally undivided in various species, frequently so in *T. monticola*). Venom haematoxic.

Range.—Peninsula India and northern India as far west as Punjab; east through the Himalayas into Szechwan and, south of the Yangtse Kiang, to Kiangsu, the Ryuku Islands and Taiwan. South through the Malay Peninsula and hence east throughout the Philippine and the Greater Sunda islands, with the exception of Celebes, and through the Sunda Archipelago as far as Wetar and Timor.

The genus as described above contains the following species arranged in the form of a natural key. The key is by no means perfect, but in conjunction with the ranges roughly outlined with each species, correct identification should be possible. The greatest difficulties will be met in separating out the various green species, especially if the specimen in hand is a female. In spite of Stejneger's (1927) and Pope's (1933) work on these forms, the status of *albolabris* and *popiorum* is far from certain.

A Key to the Species of *Trimeresurus* Lacépède

A1 Hemipenis with true spines.

B1 Color dominantly brown, dorsal pattern consisting of at least two series of large brown marks, these marks predominantly paired, frequently fused to form a large median saddle. Supraocular scales undivided (if divided take alternative A2).

C1 Clearly possessing at least three of the following four characters. No scales between upper part of second labial and nasal; anterior head scales large and symmetrically arranged; one scale between supraocular and internasal above the canthus; canthus rostralis and snout distinctly darker (almost black) than crown, mask-like. In addition to these characters the suboculars are frequently divided .... *monticola* group

D1 Tail short, less than ten per cent of the total length; subcaudal scales numbering less than 30; two to five interocular scales.

E1 Sixth supralabial larger than third. Borneo .... *chaseni*

E2 Third supralabial largest. Malay Peninsula south of the Isthmus of Kra .... *convictus*

D2 Tail longer than ten per cent of total length; subcaudal scales more than 35; six to nine interocular scales.

E1 Scales distinctly keeled; seven or eight supralabials; two or three azygous scales between internasals; each mark of the dorsal series subtended by a single small brown spot; a second series of lateral spots on first scale row alternates with dorsal marks. Ryukyu Islands.... .... *okinavensis*

E2 Scales smooth or weakly keeled; no azygous scales; each mark of dorsal series subtended by a triad of spots, the center spot being the smallest; two other series of lateral spots, one above the other, alternate with the dorsal marks. Mountainous regions west of Nepal to Chekiang, China and south into Burma and French Indo-China.... .... *monticola*

C2 One to five scales between upper part of the second labial and nasal; anterior upper head scales small, showing no symmetry; two to four scales between supraoculars and internasals above canthus; no mask-like darker color around snout and canthus; subocular scale undivided.

D1 Area of each internasal five to ten times as large as adjacent head scales; lacrimal separated from subfovial scale; crown not reticulated with a darker color (simple pattern present in juveniles)..*mucrosquamatus* group

E1 Two scales on a line between upper preocular and nasal; lower head scales whitish, interstitial skin slightly pigmented. Assam, North Burma, West, Central and Southeastern China, North French Indo-China, and Taiwan .... *mucrosquamatus*

E2 One scale between upper preocular and nasal; lower head scales tan with brown spots. Southern Ryukyu Islands............ *elegans*

D2 Area of each internasal one to two times as large as adjacent head scales; lacrimal scale fused to subfovial scale; crown reticulated with a darker color (black or brown) .... *jerdonii* group

E1 Second labial enters loreal pit; subcaudal scales numbering more than 50 in males, 40 in females.

F1 Scale rows 21 or less at midbody .... *jerdonii*

G1 Ventrals 164–187, subcaudals 42–67. Assam and Northern Burma .... *j. jerdonii*

G2 V. 160–173, sc. 44–57, Northern Yunnan, S.W. Szechwan.. ....*j. melli*

G3 V. 176–188, sc. 54–67. Central and eastern Szechwan and Hupeh, China ....*j. xanthomelas*

G4 V. 189–192, sc. 65–72. Southern Yunnan and Tonkin.... ....*j. meridionalis*

F2 Scale rows 25 or more at midbody. Northern Ryukyu Islands ....*flavoviridis*

G1 25 to 31 scale rows. Takashima Island.......*f. takarensis*

G2 33 to 39 scale rows. Okinawa and Amami-Oshima subgroups ....*f. flavoviridis*

E2 Second labial does not enter loreal pit; subcaudal scales numbering less than 45 in males, 35 in females. Peninsular India......*strigatus*

B2 Color green; occasionally indistinct pattern of narrow black rings is evident.. ....*stejnegeri* group

C1 Eight to ten interoculars; three or fewer median scales between azygous scales and a line connecting anterior tips of supraoculars; inner edge of supraoculars irregular but seldom cut into by sutures. Peninsular India..*gramineus*

C2 Eleven to sixteen interoculars; four to six median scales between azygous scales and a line connecting anterior tips of supraoculars; inner edge of supraoculars frequently cut into by sutures ....*stejnegeri*

D1 Scale rows 21 at midbody. Central and S.E. China, Taiwan, Tonkin, and Hainan ....*s. stejnegeri*

D2 Scale rows 19 at midbody. Sikkim, Northern Burma, and Yunnan China ....*s. yunnanensis*

A2 Hemipenis entirely devoid of spines, but fleshy spinelike papillae may be present.

B1 Supraoculars usually divided into two to five scales; dorsal pattern present but not consisting of simple transverse bands of alternating colors or of dorsal series of small yellow or white spots ....*puniceus* group

C1 Five to ten median scales between azygous scales (internasal suture if azygous scales are absent) and a line joining anterior tips of the supraoculars; green absent in dorsal coloration.

D1 First infralabials transversely divided, labial portions not in contact with each other nor touching chinshields.

E1 One scale between upper preocular and nasal; no scales between upper part of second labial and nasal; supraocular usually single, one and one-half times as long as broad. Taiwan ....*gracilis*

E2 Two or more scales between upper preocular and nasal; two to four scales between upper half of second labial and nasal; supraoculars divided.

F1 Second labial excluded from loreal pit (occasionally enters); twelve to fourteen interoculars; supraoculars slightly raised to form "lashes" over eyes. Sumatra, Java, and Borneo...*puniceus*

F2 Second labial enters loreal pit; nine to eleven interoculars; supraoculars not raised to form "eyelashes." Borneo....*borneensis*

D2 First infralabials in contact with each other and anterior chinshields; supraoculars strongly developed into "eyelashes." Tonkin.......*cornutus*

C2 One-half to three median scales between internasal suture (or azygous scale if present) and a line joining anterior tips of supraoculars; green present in dorsal pattern; supraoculars usually divided.

D1 Dorsal scales usually black and yellow; upper surface of head black, spotted with yellow. Western Ghats of Peninsular India....*anamallensis*

D2 Dorsal scales green though frequently with black bases; upper surface of head with a symmetrical black and green pattern. Ceylon.......... ....*trigonocephalus*

B2 Supraoculars very rarely divided; dorsum immaculate or if pattern present consisting of simple transverse bands of alternating colors or occasionally of two dorsal series of small white or yellow spots.

C1 Distinctly keeled scales immediately above posterior supralabials; 25 or more scale rows at midbody ....*purpureomaculatus* group

D1 Lateral stripe present; dorsal color brown to purplish but frequently suffused or spotted with green.

E1 Interoculars raised into obtuse keels; first infralabials completely separated by mental scale. Eastern Peninsular India.... *acutimentalis*

E2 Interoculars not raised into obtuse keels, smooth; first infralabials in contact posterior to mental scale (occasionally infralabials are separated by mental scale).

F1 One scale between upper part of second labial and nasal; six (five to eight) scales between supraocular and nasal above canthus; ventrals less than 170. Malay Peninsula and N.W. Sumatra .... *purpureomaculatus*

F2 No scales between upper part of second labial and nasal; three or four scales between supraocular and nasal above canthus; ventrals more than 170. Andaman and Nicobar Islands.. *cantoris*

D2 Lateral stripe absent; dorsal color a bright green. Sikkim, Assam, Bengal and Burma .... *erythrurus*

C2 Smooth scales immediately above posterior labials, temporal scales above these smooth scales may be weakly keeled; 21 or fewer scale rows at midbody.

D1 Ventrals numbering more than 170 in males, 175 in females; lateral stripe if present never a continuous stripe anteriorly but consisting of a series of white or yellow spots .... *sumatranus* group

E1 Color greenish to purplish brown or brown; scales with dark edges (sometimes indistinct).

F1 Interoculars four to nine, usually six or seven; two median scales between internasal suture (or azygous scale if present) and a line joining anterior tips of supraoculars; color usually green .... *sumatranus*

G1 Scales in 21 rows at midbody. Sumatra and Borneo...... .... *s. sumatranus*

G2 Scales in 19 rows at midbody. British North Borneo.... .... *s. malcomi*

F2 Interoculars ten or eleven; four to seven median scales between azygous scale or scales and a line joining anterior tips of the supraoculars; color usually brownish. Palawan Island, P.I... .... *schultzii*

E2 Color green or yellow or ringed with transverse reddish bands; scales without dark edges.

F1 Dorsal color uniform yellow. Batan Island, P.I..... *mcgregori*

F2 Dorsal color never uniform yellow.

G1 Lateral line absent; tail dark colored, purplish. Pollilo Island, P.I. .... *halieus*

G2 Lateral line present; tail light colored. Philippine Islands exclusive of Palawan and Pollilo Islands.... *flavomaculatus*

D2 Ventrals numbering less than 170 in males, 175 in females; lateral stripe if present continuous anteriorly .... *albolabris* group

E1 Upper head scales small; ten or more interoculars; scales in odd numbered rows.

F1 Internasals separated by one or more azygous scales; first labial completely separated from nasal; one or more scales between upper half of second labial and nasal.

G1 Color brownish or gray. Nicobar Islands....... *mutabilis*

G2 Color green. Borneo, Thailand, Cambodia, Malay Peninsula, N.W. Sumatra, mountainous regions of Upper Burma, Assam .... *popiorum*[1]

[1] Either a poorly defined species or still incompletely understood. It usually possesses two of the three characters outlined above under alternative F1. Peripheral populations are quite stable as to various characters and are clearly defined. The species undoubtedly exhibits subspeciation, but until large numbers of individuals are available from a number of localities the recognition of subspecies would be pointless.

F2 Internasals in contact; first labial partially (more rarely completely) fused to nasal; no small scales between upper half of second labial and nasal.
G1 Color light brown. Nicobar Islands .... *labialis*
G2 Color green. Fairly distinct in S.E. China, Taiwan, Hainan, French Indo-China, Sunda Archipelago from S.E. Sumatra to Wetar and Timor .... *albolabris*[2]
E2 Upper head scales large; six or fewer interoculars; scales in odd or even numbered rows.
F1 Six interocular scales; first labial fused to nasal; scales in 21 rows at midbody. Djompei Island, between Celebes and Flores .... *fasciatus*
F2 One to three interocular scales (one anteriorly); first labial separated from nasal; scales in 12 or 14 rows at midbody. Western Ghats of Peninsular India .... *macrolepis*

[2] Difficult to distinguish or closely approaching *popiorum* in N. India [Punjab] east through Upper Burma, Malay Peninsula, N.W. Sumatra.

This study would have been impossible had it not been for the generous cooperation of the American Museum of Natural History, the California Academy of Sciences, the Field Museum of Natural History, the Museum of Comparative Zoology, the Natural History Museum, Stanford University, and the United States National Museum. Through the loan of specimens from these museums it was possible to examine specimens of all the 32 species listed in the key except the following: *convictus, gracilis, cornutus, acutimentalis, cantoris, mutabilis, labialis,* and *fasciatus*. *T. mutabilis* and *labialis* are probably subspecies of *popiorum* and *albolabris*. The other unexamined species, judging from descriptions, appear to be related to forms which have been examined. I also wish to take this opportunity of thanking Mr. Joseph R. Slevin, California Academy of Sciences, Dr. G. S. Myers, Natural History Museum, Stanford University, and Dr. Alden H. Miller, Museum of Vertebrate Zoology, for numerous suggestions pertaining to this paper.

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Notes on the Life History of the Mud Snake

By Fletcher A. Reynolds and Archie N. Solberg

DURING the latter part of June, 1938, an exceptionally beautiful and heavy bodied specimen of the mud-snake, *Farancia abacura abacura* Holbrook, 56 inches long, was received at the Toledo Zoological Park. The snake was placed in a cage containing a large pool of water and kept under observation in the hope of observing egg-laying. Meade (1937: 12) reported on the breeding habits of the snake in captivity and in other publications on the egg laying (1935: 190), maternal care of eggs (1940: 15), feeding habits (1934: 91) and hibernation in captivity (1935: 99); Goldstein (1941) has reported collecting eggs in the field in Florida.

Early in the morning of July 9 the mud-snake crawled from the water to the rocks above the pool and appeared to be nervous and in search of a suitable place to deposit her eggs, finally coiling in a level spot some 2 feet directly behind and above the pool. On the following morning several eggs were observed beneath her coils. When the cage was opened the snake paid no attention to the intruder. She was left coiled about her eggs until the next morning, July 11, when it was found that she had left the clutch and was moving about the cage. The eggs were then removed and found to number fifty-four.

The eggs were not adherent, white in color, elliptical in shape, and with shells of a smooth, leathery texture. The average weight per egg of thirty that were weighed was 12.3 grams.

A large glass container was filled with moist sand, and ten of the eggs were buried about one half inch below the surface of the sand in the container. The jar was then placed in a "sun incubator," and the eggs were kept as near the original degree of dampness as possible by daily sprinkling, at 72° to 75° F.

The first examination of the buried eggs was made on July 21. Because the shells were slightly discolored and very tight, it was thought that the eggs were probably too damp, and the sprinkling was reduced to once or twice a week. An egg taken from the container and opened on July 27 was found to contain a live embryo, but apparently the eggs were still too moist, and less water was added during further sprinklings. Three of the eggs had spoiled by this time. Another egg examined on August 10 contained a live, fairly well developed embryo. The tail was firmly attached to the trunk and the pulsations of the heart could be seen distinctly. At the same time another spoiled egg was found and removed. An egg opened on the morning of September 7 contained an embryo ready to hatch. The embryo was weak and died during examination.

The three remaining eggs were then placed in a vivarium prepared from an aquarium tank. The bottom was covered with approximately 2 inches of fine sand and a shallow water pan was buried in the sand at one end so that its top was flush with the surface of the sand. Leaves were scattered about the floor to furnish hiding places for the young snakes.

The following morning the embryos were restless within the leathery shells. One egg was cut slightly with a scalpel, and about one hour later the young snake crawled to the floor of the vivarium and soon hid beneath the leaves. The two remaining eggs hatched during the night. All three of the young snakes were equipped with a small egg tooth which was shed by the morning of September 10. Their weights and lengths were 5, 6, and 8 grams, 202, 222, and 230 mm. Lengths recorded by Meade and Goldstein varied from 152 to 243 mm.

Various food, such as earthworms and insects, was offered the three young snakes, but none was taken. One specimen died on September 12. The remaining two lived six and eight weeks, respectively. Most of their time was spent hidden under the leaves in their water pan.

The adult continued to refuse food until February 6, 1939. On this date a frog (*Rana pipiens*) was offered from the hand and held close to her nose. The snake promptly struck the frog and proceeded to swallow it.

This snake ate regularly from the hand from this date, until October 5, 1939, when it was accidentally killed. It became very tame and would glide to the edge of the pool to receive food when offered. Most of the time was spent in the water. The skin was shed four times during the sixteen months of observation. Salamanders such as *Ambystoma tigrinum* and *A. texanum* were offered occasionally and some were accepted, but a preference was shown for *Rana pipiens*. Van Hyning (1932) found frogs in only 8% of the contents of twenty-five *Farancia* stomachs.

We are indebted to Frank L. Skeldon, Director of the Toledo Zoological Park and Executive Secretary of the Toledo Zoological Society for his helpful suggestions and cooperation in the preparation of this manuscript.

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The Occurrence of Nuptial Tubercles on the Female of *Osmerus mordax* (Mitchill)

By LAURENCE L. RICHARDSON

NUPTIAL tubercles appear as male adornments in many species of fishes at the mating season. Hypertrophy of epidermal cells in minute patches gives rise to the tubercles which commonly occur on the fins, head or body (e.g. *Barbatulus, Catostomus, Moxostoma, Carassius,* etc.), or a similar but more extensive hypertrophy leads to the formation of thickened pad-like areas (e.g. *Pimephales*). Such structures are generally considered as purely male developments. It is therefore of value to record that while examining sections of the skin of gravid male and female smelt, *Osmerus mordax* (Mitchill), it was found that a similar hypertrophy of epidermal cells in minute patches is present on the females as well as the males of this species. The development of tubercles in the female is barely visible to the naked eye, while the male is obviously and richly adorned.

Kendall (U.S. Bur. Fish., No. 633, 1908) has briefly noted the presence of epidermal tubercles distributed generally on the head and body of a single mature male smelt found dead on the shore of Lake Champlain.

Specimens of *O. mordax* seined at the outlet of Lac Brulé, Province of Quebec, late in April, 1933, were preserved by Mr. G. Prevost and later sent to me for identification since the appearance of these specimens was markedly altered from the usual owing to the great development of tubercles. The collection consisted of eleven mature males ranging in length from 11.0 to 12.2 cm., and a single gravid female 11.5 cm. long. The specimens were heavily coated with mucus, and while removing this from the female I noted the presence of minute white patches scattered over the dorsum of the head. The appearance was that of an attack of ichthyopthiriasis, and having an interest in that disease at the time, I sectioned a small portion of the skin. Later, I obtained additional specimens of gravid females from Lake Memphremagog, and in this material as well similar patches were present on the head, and were also detectable in sections of the skin from the back alongside the dorsal fin but not elsewhere on the body. Small portions of the skin from the top and sides of the head and of the body, as well as parts of the pectoral, pelvic and dorsal fins were removed from male and female specimens, sectioned and examined.

In the normal condition, the stratum germinativum of the skin rests upon a thick layer of compact connective tissue and consists of the usual columnar cells with ovoidal nuclei (8μ by 3μ) placed with their greatest axis at right angles to the surface of the skin. Peripheral to this there is an intermediate layer of transitional squamous cells with subovoidal ($6\mu - 8\mu$ by 3μ) nuclei, and most superficially two or three layers of squamous cells with compact elongate nuclei (3μ long) lying parallel to the surface of the epidermis. The number of cell layers forming the epidermis differs on the various regions of the body, the epidermis being thickest on the head and back where there are twelve to fifteen layers of cells all together, thinner on the sides of the body, and thinnest on the fins where the total number of cell-layers is only

four or five. The individual tubercles result from the hypertrophy of the cells throughout the depth of the epidermis. This involves not only the intermediate and superficial layers but also the columnar layer at this point. There is no indication of hyperplasia, and the thickness of the epidermis at the tubercle is due to the extensive increase in size of the individual cells of the several layers. The cells of the centre of the tubercle characteristically show the greatest enlargement and in particular have spherical nuclei (8μ by 8μ). The limits of the tubercle are sharply defined and there is no gradation or transition between the cells of the tubercle and the adjacent epidermal cells. In many cases, it seems that the rapidly growing cells of the tubercle have pressed against and compacted the adjacent cells of the epidermis surrounding the tubercle. This suggestion is strengthened by the fact that the diameter of the tubercle is narrower in the columnar layer than in the intermediate layers. The microscopic picture of the tubercle is very definite and readily recognizable.

Examination of the sections of the skin from the head of the female shows that the tubercles developed on the head are similar to those of the male, but differ in that the cells of all layers are not so much hypertrophied. The cells of the intermediate and superficial layers are more depressed in the tubercles of the females than in the males. As a result, the tubercles of the females do not rise markedly above the surface of the skin and are generally more compact. Tubercles were not found in sections of the fins of the females, but in sections of the skin from the body alongside the dorsal fins, obvious hypertrophy of epidermal cells in the form of small patches over the exposed end of the scales was observed. The hypertrophy in this case does not form a tubercle visible to the naked eye, and the formations may best be described as small irregular patches of enlarged epidermal cells not extending above the surface of the epidermis. The individual cells are of smaller size than in fully formed tubercles but are larger than the normal and have distinctly spherical nuclei.

The nuptial adornment of the male is very strongly developed. Small rounded soft tubercles 0.5 mm. in diameter are abundant on the top and sides of the head. The antorbital region, the cheek, opercle and maxilla are not as thickly covered as the dorsum of the head. On the lower portion of the head, the tubercles are restricted to the skin over the mandibles, the branchiostegal rays and the throat. Similar small rounded tubercles are present on the skin covering the rays of the dorsal and pectoral fins, and as in the branchiostegal membrane, the tubercles are absent from the areas of skin between the rays. In the fins, a marked general thickening of the epidermis along the anterior edge is present. The individual tubercles on the body are elongate and have a very precise arrangement. They are generally larger (1.5 mm.) than those on the head and fins. Each tubercle is situated over a scale and has the form of a ridge extending from the anterior to the posterior margin of the exposed portion of the scale. The individual scale appears keeled, and the general effect over the greater part of the body is one of a series of longitudinal parallel ridges, not unlike the keeling on the skins of such colubrine snakes as *Heterodon contortrix*. The tubercles are largest along the level of the lateral line and diminish gradually in size to-

wards the dorsal and ventral aspects of the body, until on the belly they are represented generally by one large and several smaller rounded tubercles to each scale. A similar but more abrupt transition takes place dorsalwards, but on the back only a single tubercle is present to each scale.

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Descriptive Notes on the Serranid Fish, *Garrupa nigrita* (Holbrook)[1]

By LEONARD P. SCHULTZ and EARL D. REID

RECENTLY, in attempting to identify some fishes from the Gulf of Mexico sent to the United States National Museum by Dr. E. H. Behre, of Louisiana State University, an immature specimen of a serranid fish gave the authors some trouble because it had an antrorse spine at the lower angle of the preopercle, resembling *Alphestes*. This small specimen was identified as *Garrupa nigrita* (Holbrook). Two other specimens and a cast of this species are preserved in the National Museum. Because we can find no description of the young of *Garrupa nigrita* (Holbrook, Ichthyology of South Carolina, 1,1855 and 1860: 177, pl. 25, fig. 2) we are fortunate to have two specimens and describe them below along with the two large ones.

DESCRIPTION.—Based on the following specimens, one 106 mm. standard length (total length 133.5) collected under the direction of Dr. E. H. Behre at Grand Isle, Louisiana, summer 1941, USNM Cat. No. 119701; and another 136 mm. standard length (total length 166) from near Corpus Christi, Texas, collected by Prof. C. T. Reed, USNM Cat. No. 94551. A specimen 610 mm. standard length (705 mm. total length) from Pensacola, Florida, May, 1878, Silas Stearns, USNM Cat. No. 21329; and a cast made from a specimen taken off Block Island, May 20, 1884, Capt. S. J. Martin, weight 300 pounds, USNM Cat. No. 34883, have been measured and included below for comparison with the two small specimens.

The following measurements are expressed in hundredths of the standard length respectively, those for the smaller fish enclosed in parentheses and the larger ones outside the parentheses. Length of head (44.4; 43.4) 37.5; 36.0;

[1] Published with the permission of the Secretary of the Smithsonian Institution.

postorbital length of head (26.7; 25.3) 24.2; 22.7; length of snout (11.8; 11.6) 9.6; 11.8; diameter of eye (9.6; 7.7); 4.8; 3.5; tip of snout to posterior end of maxillaries or length of mouth (23.0; 21.0) 18.4; 15.8; width of fleshy interorbital space (8.9; 8.6) 7.8; —; least width of preorbital bone below front of eye (4.2; 4.0) 4.8; 5.5; greatest depth of body (41.4; 38.5) 36.1; —; least depth of body (13.0; 12.1) 12.5; 12.3; length of caudal peduncle or distance from rear base of last anal ray to mid-base of caudal fin (17.9; 14.5) 19.0; 23.0; distance from snout to origin of dorsal (38.4; 38.6) 37.7; 37.9; snout to anal fin (72.5; 65.9) 65.5; 72.7; snout to insertion of pelvic fins (51.5; 46.0) 34.8; 38.5; snout to pectorals (44.6; 43.6) 32.5; 31.1; distance from anal origin to insertion of pelvic fins (24.4; 27.5) 35.3; 36.0; length of longest dorsal spine (third 19.0; 18.4) second, 15.1; 18.0; length of first dorsal spine (7.4; 6.4) 9.4; 4.0; length of longest soft ray of dorsal (22.2; 20.2) 14.8; 8.1; length of longest soft ray of anal (24.2; 19.9) 15.6; 11.2; length of first anal spine (7.7; 6.4) 3.0; 1.9; second anal spine (13.9; 12.5) 6.6; 2.8; third anal spine (15.5; 14.0) 8.9; 3.1; length of longest pelvic ray (28.3; 24.7) 17.9; 16.8; longest pectoral ray (25.5; 23.2) 19.0; 15.5.

The following counts were made, respectively: Dorsal rays (X, 14; X, 14) X, 15; X, 14; anal (III, 9; III, 9) III, 9; III, 9; pectoral (both sides i, 18 and i, 18; i, 18 and i, 18) i, 18 and i, 18; —; pelvics (I, 5; I, 5) I, 5; —; gill rakes first arch (9 + 1 + 14; 9 + 1 + 14) 9 + 1 + 14); —; scale rows on sides (104; 111) 115; —; scales above lateral line from base of first soft ray of dorsal 15; 18; 15; —; scales from anal origin to lateral line 32; 30; 30; —; pores in lateral line 72; 72; —; —.

Inner teeth of both jaws depressible, front of premaxillaries with enlarged conical teeth, the pair at each side of the mid-line where the maxillaries join, canines; villiform teeth on vomer and palatines.

The posterior margin of the preopercle in the young is finely serrated, these serrae becoming slightly enlarged ventrally, and at the lower angle a few spines are greatly enlarged, mostly directed downward and backward. The most anterior spine at the lower angle of preopercle is conical and points slightly forward, or is slightly antrorse as in *Alphestes*. None of the spines on the lower angle is coalescent in the young; although in the adult (610 mm.) they are arranged almost identically, they become flattish and more or less coalesce and move more to the vertical margin of the preopercle so that none of the spines point forward. The antrorse spine now occupies the lower angle and is directed downward and backward. The third spine of the dorsal longest (the second or third is longest in adults); the spinous dorsal fin when extended has almost a straight margin from the third to last spines; the third anal spine projects a little beyond the second when that fin is extended; caudal fin rounded; pelvic fins reaching to origin of anal, their insertion under a vertical line extended through base of first or upper ray of pectoral fin.

Color in alcohol plain dark chocolate brown on one specimen and plain light brown on the other, which has a few pale blotches on the sides; a black line on front of cheek extending from narrowest part of the preorbital bone, where maxillary fits into a groove, to opposite the rear end of maxillary.

UNITED STATES NATIONAL MUSEUM, WASHINGTON, D.C.

Limits and Status of the Fish Group Rhegnopteri

By Carl L. Hubbs

QUERIES by some of my students remind me of the confusion that exists concerning the families which are referable to the Rhegnopteri. The purpose of this note is an attempt to stay the spread of erroneous ideas regarding the limits of this group, to clarify its treatment by certain authors, and to discuss its status.

In analyzing the "suborders and other groups of Acanthopteri" Jordan and Evermann (1896: 781 and 827) followed Gill (1893: 137) in referring to a "suborder Rhegnopteri" the one family Polynemidae. The outline classifications of Gill and of Jordan and Evermann and the group definition by the latter authors indicate clearly that the name Rhegnopteri was intended to apply only to the threadfins. From the first, however, misconceptions arose as to the limits of the group. The confusion was probably due to Jordan and Evermann's dual ranking of the primary divisions of the spiny-rayed fishes. They recognized in turn the "suborders" Salmopercae, Xenarchi, Percesoces, and Rhegnopteri; then a series of "groups" (with names based on that of the type genus with the suffix *-oidei* or *-oidea*); and finally another sequence of "suborders" (with names based on a character or on a fish name, with merely a plural suffix). Even the editor of *Bulletin 47* misinterpreted the authors' obvious intent of treating all these divisions as coordinate, for, in the analytical table of contents (pt. 1, 1896: xlv–lvii, and pt. 4, 1900: xliii–lxiv) he subordinated all the "groups"—Ammodytoidei, Berycoidei, Scombroidei, Percoidea, and Cirrhitoidei—under the "suborder" Rhegnopteri.

The basis for confusion was essentially repeated in Jordan's *Classification of Fishes* (1923), in which there are successively treated, under "order" Percomorphi, the following groups: "suborder" Percesoces; "suborder" Rhegnopteri (now under consideration); "series" Scombriformes; then a sequence of other "series," derived from the disruption of the presumably artificial assemblage of Scombroidei; and finally a number of other intendedly coordinate groupings which were alternately ranked as "series" and "suborders" (among which the Percoidea were inadvertently left without a group heading). Here the "group" names with the *-oidei* ending were replaced (and augmented) by "series" names with the *-iformes* suffix, and "suborder" names were largely repeated from the classification of 1896–1900.

Again one might erroneously assume that some of these coordinate groups (the percomorph "series" of 1923) were meant as divisions of the suborders. This was obviously not the intention of Jordan, who used the "series" as a rather indefinite group ranking: "Usually but not consistently the names of series are formed by adding the suffix *-iformes* to the root of the typical genus of the group. In most cases the series are used as strictly or approximately coordinate with suborders, but once a series (Ostariophysi) is used to include several orders, while in a few instances series are subordinated to suborders." (Hubbs, 1923.)

Small wonder then that misconceptions have arisen concerning the contents of the group Rhegnopteri. As an example of the misuse of this group

name, mention may be made of a paper (Deraniyagala, 1933) in which the accomplished ichthyologist of Ceylon writes that "The Rhegnopteri comprise some of the largest and speediest of oceanic fishes" and proceeds to deal with various large scombroids.

"Suborder Rhegnopteri" Gill (1893: 137) is the exact equivalent of "super-family Polynematoidea" Gill (1872: 7, and 1873: 786), "superfamily Polynemoidea" Gregory (1907: 452), "suborder Polynemoidei" Regan (1909: 79) and "suborder Polynemoidea" Regan (1913: 111). Unfortunately there is little in general practice and nothing in the *International Rules* to determine which of these names, if any, should be adopted. But whichever of these designations (or yet another substitute name) is accepted, the group should encompass only the Polynemidae.

Many authors of the nineteenth and twentieth centuries have included the Polynemidae in the Percesoces rather than in a distinctive group, but the several authors herein cited, at least in their later papers, have classed the threadfins in a group separate from the Percesoces. In 1909 (p. 79) Regan included his suborder Polynemoidei in the order Percesoces, but since 1913 (p. 111) has treated suborders Mugiloidea (equivalent to Percesoces) and Polynemoidea as coordinate divisions of the order Percomorphi. This latter judgment, which harmonizes with the views of Gill and other acute taxonomists, and which apparently interprets as secondary the resemblances between polynemids and mugilids, seems to be the sounder.

The ranking of the group based on the Polynemidae—whether as superfamily, series, or suborder—is not in my opinion a question of any real meaning and certainly not one worth discussion. There is no natural or objective criterion for differential group ranking. The significant point is to have this group, like any other, named and delimited, to know its constituent elements and to understand of what larger group it is a subdivision.

The desirability of recognizing as such the Rhegnopteri (or Polynematoidea or Polynemoidea or Polynemoidei) is open to question. There is grave doubt in my mind as to the need for groups and group names—above the family rank that enters into routine systematics—when the successive rankings include identical elements. What earthly difference is there between the "order" Amphioxi (Cirrostomi), the "class" Leptocardii (Myelozoa), and the "subphylum" Cephalochordata? Why encumber the system with "Rhegnopteri" when Polynemidae covers the same ground? Why not relegate the names and discussions of groups higher than family rank to separate or introductory treatment—preferably in an outline form uncomplicated by several names for the same thing, and unconfused by meaningless considerations of rank?

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The Effect of Jaw-Tagging upon the Condition of Trout

By HOWARD A. SCHUCK

INTRODUCTION

MANY phases of fishery investigation require that fish be identified at some time after planting. Certain information on survival and migration can be obtained through methods of marking which permit only group identification. However, data on growth and other phases of fishery research can best be obtained by individual recognition. Various types of numbered tags have been employed for this purpose. Jaw-tags, following the method described by Shetter (1936) are frequently used.

Apparently no attempt has been made to determine what effect tagging has upon the fish. With a considerable amount of investigation in progress which is more or less dependent upon the use of tags it appears important to evaluate tagging techniques. If the effect of tags is negligible, then data obtained from the observation of tagged fish might be assumed to be representative of normal untagged individuals and could be used with no modification. If, however, tags have some deleterious effect upon the fish carrying them, then some adjustment would be necessary in applying the results of experiments which have utilized tagging.

One of the important investigations in progress at Crystal Creek, New York State's experimental stream, is the determination of the growth rate of wild brown trout. Individual fish have been jaw-tagged and weighed and the total length has been measured. They are recovered from time to time to determine, among other things, increments in length and weight. It is important to find out if these data can be used to represent normal, wild untagged fish in this stream, or whether the tags have significantly affected

the fish so as to make them unrepresentative of the stream population.

One criterion which might be used to judge the relative well being of these tagged and untagged fish is the condition or relative heaviness. Fish relatively heavy for their length may be assumed to be in good condition whereas fish relatively light for their length may be considered to be in poor condition. In this study, the effect of jaw-tagging on wild brown trout will be evaluated in terms of the condition of these fish as compared with the condition of a group of untagged fish of the same population. The mean weight of the tagged group will be compared with the mean weight of the untagged fish on the basis of a mean standardized length (Mottley, 1941).

Table I

Total Lengths in Centimeters and Weights in Grams of Tagged and Untagged Wild Brown Trout Taken in Crystal Creek with the Electric Shocker in 1939, 1940 and 1941

TAGGED TROUT				UNTAGGED TROUT			
Total length in centimeters	Weight in grams	Total length in centimeters	Weight in grams	Total length in centimeters	Weight in grams	Total length in centimeters	Weight in grams
19.6	73.9	25.5	167.8	18.4	65.9	18.0	75.9
16.5	41.3	32.1	347.5	21.3	103.4	17.8	60.9
17.3	53.5	24.2	143.0	18.2	68.3	17.5	60.6
18.6	67.4	24.8	152.5	20.4	100.9	20.2	93.6
20.7	98.9	28.8	245.0	15.1	38.2	24.0	152.0
23.1	125.9	15.8	39.6	17.0	52.5	18.8	63.6
15.9	37.1	25.9	192.2	14.9	35.9	20.0	84.1
20.2	80.2	25.8	177.5	19.5	73.5	17.3	60.6
15.1	36.0	16.6	45.8	17.2	58.8	15.2	36.9
15.8	44.7	17.6	46.5	21.2	101.1	33.3	400.0
18.5	64.7	18.0	50.0	16.5	47.2	17.7	58.1
18.2	67.7	16.9	38.4	19.6	78.2	23.4	139.8
22.4	120.1	21.3	82.6	18.4	73.5	14.5	34.8
17.8	56.7	21.0	98.6	21.5	109.1	26.7	225.5
18.5	71.0	17.9	57.7	16.1	38.6	18.1	67.3
15.6	42.1	28.5	293.1	15.2	38.5	18.3	59.8
27.9	243.7	24.5	177.2	17.3	55.6	21.3	110.0
25.3	181.0	22.5	111.9	18.8	72.6	22.3	114.0
26.4	207.6	26.3	215.1	16.3	50.0	21.8	108.1
17.4	62.5	26.4	217.9	16.8	55.1	24.1	162.4
19.8	88.5	24.3	142.1	17.2	51.7	16.4	49.5

Materials and Methods

During the course of the trout investigations at Crystal Creek, it has been a practice to obtain population estimates of thirteen sections of the stream by use of the electrical shocking method, as described by Haskell (1940) and Haskell and Zilliox (1941). This method of study has been carried on in three seasons, during the late summers of 1939, 1940 and 1941. In these years a large number of wild brown trout have been captured. All fish over 6 inches have been weighed in grams, the total length measured in centimeters, tagged with jaw-tags, and released. During the operations of the following years, a total of 42 of these tagged fish were recovered, weighed and measured again. In addition, 125 wild brown trout were captured for the first time, untagged. Lengths and weights were recorded for these fish also. Thus, lengths and weights are available for two groups of fish: 1. Fish tagged for a period of one and two years, and 2. Fish never tagged. These fish are to our knowledge similar in all other respects.

The Data

For the test of condition between the two groups, data from all 42 tagged fish were utilized. A representative group of 42 untagged fish was obtained by taking a random sample from the available population of 125. Thus, lengths and weights of a group of 84 wild brown trout ranging from 14.5 cm. to 28.5 cm. in length are available, the main difference being that 42 have been tagged for a period of one or two years and 42 have never been tagged.

The original data are shown in Table I.

The Problem and Possible Solution

The problem which must be resolved may be stated as follows: Is there a significant difference in the condition or relative heaviness of the tagged and untagged wild brown trout taken in Crystal Creek in 1939, 1940 and 1941?

The possible solution to this problem is the hypothesis which states that if length-weight data of the tagged and untagged trout recovered in Crystal Creek in the three years are compared on a basis of a standardized length, then variations will be found in the relative heaviness between tagged and untagged fish, but such variations will form a single, normally distributed population. If, however, the variations do not form such a single population, then it will be assumed that the condition of the two groups is significantly different and that tagging has had an effect upon the relative heaviness of the fish.

The Design

The design of the test of significance of the difference in the length weight relationships is the standard design for the analysis of covariance, as used by Mottley (1941). For ease in calculating, all total lengths are transformed from centimeters to decimeters. To avoid curvilinear regression and correlation between mean and variance the original data have been transformed to common logarithms. The pattern of the test is given by Snedecor (1940), and reference is made to his text for all symbols and procedures used here.

Table II

Showing the Test of Significance of the Difference Between the Mean Weights of the Tagged and Untagged Brown Trout, Adjusted for Differences in Mean Total Length

Source of variation	Deg. of freedom	Sum of squares and prod.			Errors of estimate		
		Sx	Sxy	Sy	S.S.	D.F.	Mean square
Total	83	.5853	1.7987	5.6532	.1256	82	
Tagged vs. untagged	1	.0412	.1046	.2652			
Error	82	.5441	1.6941	5.3880	.1133	81	.00140
		For test of significance			.0123	1	.0123

$$F = \frac{.0123}{.00140} = 8.79 \text{ (Highly significant)}$$

$$n_1 = 1;\ n_2 = 81$$

Test of Significance

The reduced data for the test of significance between the length weight relationships is shown in Table II. An F value of 8.79 in Table II indicates

that there is a highly significant difference in the mean weights of the tagged and untagged fish, when the effect of length has been accounted for. The adjusted mean weights for the two groups are 85.59 grams for the untagged and 80.70 for the tagged fish. These are the weights to be expected if the lengths of all fish were reduced to a standardized mean length, 19.84 cm. The mean difference in weight is thus seen to be 4.89 grams, or 6.1 per cent of the tagged weight.

The relationship between the lengths and weights of the tagged trout is shown by Equation 1, and the relationship for the untagged fish is shown by Equation 2:

1. $Y = .9561 + 3.1891\,X$
2. $Y = 1.0363 + 3.0030\,X$

where: $Y =$ logarithm of the weight in grams
and: $X =$ logarithm of the total length in decimeters

These relationships are shown in graphic form in Figure 1. The function in terms of lengths in centimeters and weight in grams is shown in Figure 2. In each figure the uppermost curve applies to untagged fish, the lower to tagged fish.

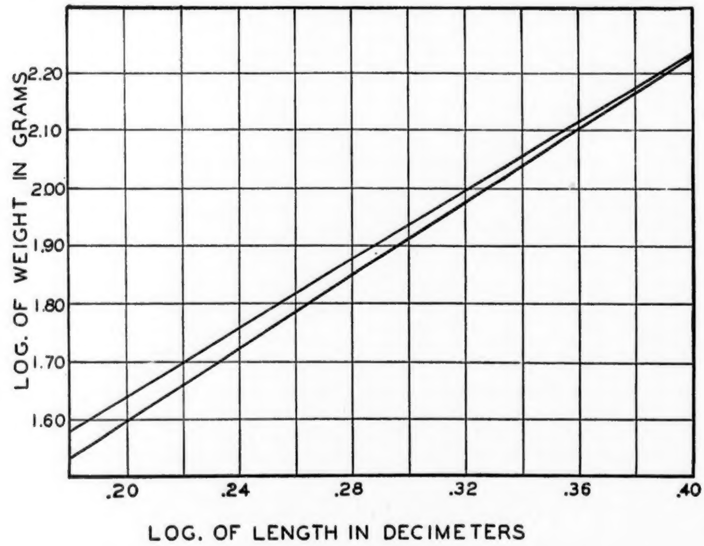

Fig. 1. The relationship between the logarithms of total lengths in decimeters and the logarithms of weights in grams for the untagged trout (upper line) and the tagged trout (lower line).

Examination of Figure 1 suggests a possible difference in the slopes of the two regression lines. It appears that the lines converge as the fish get larger. In other words, there is a possibility that larger trout are affected less than are smaller fish by these tags. The significance of this difference was tested by comparing the slopes, or regression coefficients of equations 1 and

2. The difference between 3.1891 for tagged trout and 3.0030 for the normal untagged fish proves to be just below the 5 per cent level of significance. Thus for this group of fish, the larger and smaller trout can be assumed to be equally handicapped.

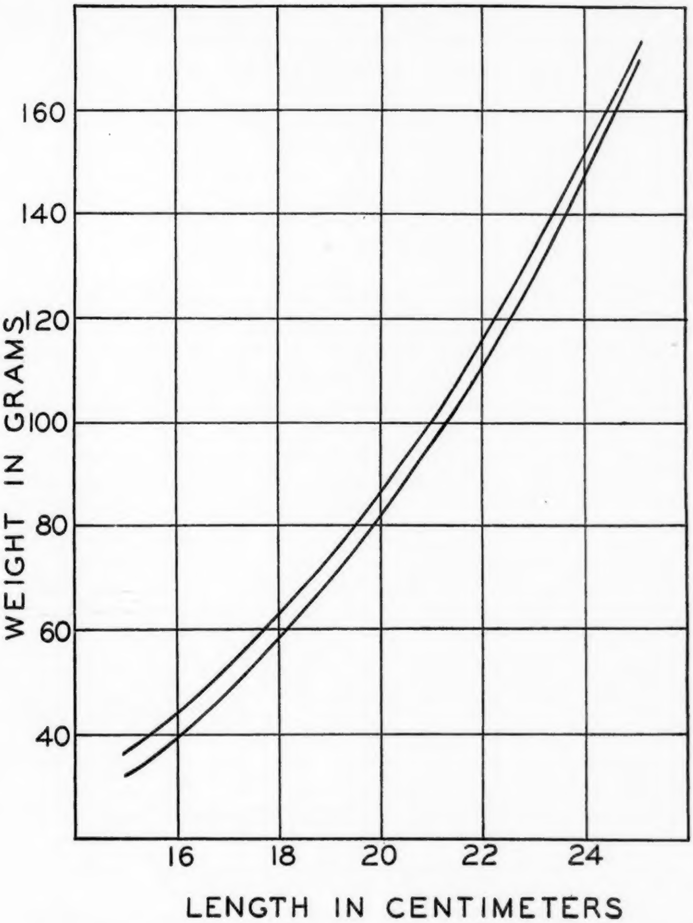

Fig. 2. The estimated relationship between the total lengths in centimeters and the weight in grams for the untagged trout (upper curve) and the tagged trout (lower curve).

Conclusions

From the evidence obtained in this study, the following assertions seem warranted:

1. In reference to the possible solution, the null hypothesis has been dis-

proved. There is a significant difference in the condition, or relative heaviness, of the tagged and untagged groups of wild brown trout studied over a three-year period in Crystal Creek. The tagged trout were consistently lighter in weight than were the untagged fish, when they were compared on a basis of a mean standardized length.

2. The weights of these tagged trout are not representative of the weights of a similar group of normal untagged fish in this stream, and any growth data from these tagged individuals would give a false picture of the growth of trout in this situation.

3. The mean difference between the tagged and untagged trout of mean length of 19.84 cm. is 4.89 grams, or about 6.1 per cent of the tagged weight.

4. There is no significant difference in the "degree of hindrance" between the larger and smaller tagged fish studied. Thus the mean difference of 6.1 per cent of the tagged weight would be the best estimate of the difference between the tagged and untagged fish considered. These fish ranged from 14.5 to 28.5 cm.

5. Inasmuch as jaw-tags have been shown to be deleterious to the condition, or relative heaviness of the wild brown trout studied in Crystal Creek, the possibility of encountering a similar effect in the utilization of jaw-tags in other situations is obvious. To remove the effect of the tags on the Crystal Creek fish, the best correcton factor would be about 6.1 per cent of the tagged weight. This correction should not be considered valid for other situations however, as various factors such as time in the stream following tagging and size of fish tagged probably operate in determining just what difference is produced in the condition of tagged fish. Although no significant difference in condition was found associated with various sized tagged trout in the Crystal Creek experiments, there seems to be a trend in this direction. Larger trout may not be as handicapped by jaw-tags as are smaller trout. Further inquiry on this point and on the general effect of jaw-tags on trout in other situations should be undertaken if the use of this method of identification is to be continued. Other types of tags and methods of tagging should also be investigated in terms of their possible effect upon the fish.

Acknowledgement

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Notes on South American Catfishes (Nematognathi)

By WILLIAM A. GOSLINE

IN 1910, Eigenmann published a catalogue of the fresh-water fishes of South and Middle America, recognizing 643 species. Since then 433 more have been described.

Such a large number of new species in this short time is to be ascribed partly to the tremendous fish fauna of the South American continent, but partly also to the great interest shown by recent authors in finding and describing new South American fishes, while leaving to the future the problem of bringing order into the existing classification. As an illustration: a 1940 paper dealing with the fishes of one of the largest of the Upper Amazonian tributaries, the Ucayali, records 35 species of catfishes, of which 15 are described as new. Furthermore this paper adds two new genera and two new subgenera to the literature.

As these descriptions of South American fishes accumulate, revision becomes progressively more difficult. Eigenmann spent much of his life doing just such revisionary work, which ended with his death in 1927, and the classification of many groups of South American fishes has by now become almost chaotic.

With the catfishes, the status even of the families is not entirely clear. In 1925 Eigenmann recognized 16 from South America. But his separations of the Nematogenyidae from the Pygidiidae on the one hand and of the Astroblepidae from the Loricariidae on the other are at least dubious, while that between the Bunocephalidae and Aspredinidae seems highly questionable. Finally, the description of *Liosomodoras* (Fowler, 1940), a genus intermediate between *Auchenipterichthys thoracatus* and *Acanthodoras cataphractus*, makes the separation of the Auchenipteridae from the Doradidae untenable.

In connection with a doctor's dissertation I have brought the section of Eigenmann's catalogue on catfishes up to date. The table below is a result of this work. The classification of the families is that of Eigenmann (1925) except as noted in the preceding paragraph.

TABLE I

SOUTH AND CENTRAL AMERICAN CATFISH: NUMBER OF SPECIES RECOGNIZED

	1890 (Eigenmann & Eigenmann)	1910 (Eigenmann)	1941
Diplomystidae	1	1	2
Doradidae (including Auchenipteridae)	76	97	127
Ageneiosidae	11	12	24
Pimelodidae	93	173	282
Helogenidae	1	1	1
Hypophthalmidae	1	1	1
Cetopsidae	6	7	12
Pygidiidae (including Nematogenyidae)	34	59	122
Bunocephalidae (including Aspredinidae)	15	22	27
Callichthyidae	25	34	44
Loricariidae (including Astroblepidae)	155	236	434
	418	643	1076

Of the families listed above, no mention will be made of the Diplomystidae. The Ariidae are omitted from the table, as they are predominantly a marine group; and the number of species recorded from fresh water would have little correlation with the number described. The Ameiuridae and Ictaluridae, North American groups with a few Central American representatives, are likewise omitted. Of the Doradidae, one subfamily, the Doradinae, has recently been revised by Eigenmann (1925), and its species are quite readily identifiable. The other subfamily, the Auchenipterinae, needs revision but is fortunately small. The same may be said for the Ageneiosidae, Cetopsidae, and Bunocephalidae. The Pygidiidae were revised by Eigenmann in 1918 and the Callichthyidae by myself in 1940.

This leaves then as a chief source of confusion the Pimelodidae and the Loricariidae. With the Pimelodidae, the most perplexing taxonomic problem has arisen from a group of these fishes, mostly small, set apart by the lack of a free orbital rim. Many of them were apparently not taken by the earlier collectors because of their small size. Certainly few had been described at the time of the Eigenmanns' revision of 1890. Fortunately, however, many of the genera of this group were dealt with in Eigenmann's British Guiana report of 1912. The classification of this group has been brought up to date recently by the author (Stanford Ichth. Bull., 2, 1941: 83–88).

With the Loricariidae the problem is threefold. First the family is very large. Even though it was revised by Regan in 1904, so many genera and species have been described since, that Regan's work is now hopelessly incomplete. Second, the Loricariidae seem to constitute a family which is still rapidly evolving. At any rate the genera, particularly, have not become

well separated, and intermediate species between many of them exist. This makes for considerable disagreement concerning the boundaries of such genera. Third, the nomenclature of several of the most important generic names is in a very confused state. *Plecostomus,* for example, has been variously accepted and rejected. Though of Gronovian origin and untenable as such, *Plecostomus* was again used by Meuschen in 1778 as an alternate generic name and hence must be considered valid as of that author. With the name *Ancistrus* the question concerns the designation of a type species, while *Cochliodon* and *Sturisoma* have been rejected by Regan for other nomenclatorial reasons. Among all these difficulties the Loricariidae have become one of the most difficult groups of South American fishes with which to work.

In concluding, one point about the South American fish fauna as a whole must be emphasized. This is the backwardness of the work on that fauna. Different groups of fishes have received varying amounts of attention, but in general South American ichthyology has not yet reached the standards set for North America by Jordan and Evermann at the end of the last century. Three main factors are responsible for this situation. One is the vast number of forms to be considered. There are undoubtedly more species of catfishes in South America than there are species of fresh-water fishes of all types in North America. A second is the great inaccessibility of many South American faunal areas. The third, and perhaps most important, is a lack of any but an academic interest in the fishes of that continent. Almost to the present day a few Indians and a handful of museum ichthyologists have been the only ones to notice whether fishes were present or absent in South American rivers. Little wonder that the fauna of these rivers remains poorly known.

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The Shedding of Teeth by *Carcharias littoralis* (Mitchill)

By C. M. Breder, Jr.

After having seen sharks shed their teeth for some twenty years it came somewhat as a surprise to learn that the process was still being questioned. Cawston (1938a, 1938b, 1939, 1940a, 1940b, and 1941) denies that there is a succession in sharks' teeth and in arguing his case states in his first two papers, "Sharks' teeth are not found in aquariums, where they would occur if constantly shed under natural conditions, but many, which have resisted disintegration after the rest of the fish has been devoured, are found on the ocean bed." In his 1940a paper he writes "Although one or two teeth have been collected and sent me from the aquarium at Tangora Park, Sydney, I do not consider there is proof that the shark which has been kept in captivity there for four years has shed any of its teeth." The shark tanks of the New York Aquarium have their floors littered with the cast teeth of sharks, literally by the thousands, numbering many more than the total number of teeth in all the sharks contained therein since the establishment of the individual tanks. These teeth are for the most part perfect and rest there mingled with the sand until removed. Thinking this an item of public interest we established a display plaque over the chief shark tank explaining the process in 1939. On this board, among other things was a large glass tube filled with several hundred teeth recovered from the aquarium. A photograph of this exhibit is shown in the Annual Report for that year, (Breder, 1940). These remarks refer to *Carcharias littoralis* (Mitchill), close to or identical with *Carcharias taurus* Rafinesque which Cawston discusses most fully. In addition to the accumulation of the teeth of *Carcharias* in aquaria, which could have no other source than shedding, direct evidence on the shedding process was repeatedly obtained. It usually took from two days to a week for the directly observable loosening tooth to become detached. Such loss of teeth generally took place a single tooth at a time. It would first be noted that one of the teeth in the front row was protruding further forward than the others. Later it would be noted that it stood straight out in an approximately horizontal position. Usually it would next be found missing but on a few occasions could be seen dangling from one of its points of attachment, that is, from either end of the broad basal portion. These occurrences were noted generally when for one reason or another the fishes were feeding lightly, for apparently the process of feeding customarily dislodged the teeth at an early time before their advanced movement could be easily noted.

This manner of losing teeth suggests that the rows advance to some extent independently of each other for never was anything noted to suggest the simultaneous loss of an entire row. Further examination of the rows in a number of jaws showed no regularity between teeth in adjacent rows, even where there was considerable overlapping of the bases. It should be noted that in the aquarium referred to there were seldom more than three sharks and consequently it was a simple matter to keep track of individual fish. Also

it is inferred that the tooth losing process was a relatively slow one for these items were not matters of daily note.

In times past, before the closing of the building and dispersion of the collection, it would have been a simple matter to confine a single shark in a cleaned tank, recover the teeth lost over a given period and estimate the speed of the process.

From the basis of these notes we can see no reason to question the propositions concerning split teeth set forth by Gudger (1933a, 1933b and 1937) as does Cawston in his various papers, on his erroneous basis that sharks' teeth are not replaced, as generally accepted. The split teeth which Gudger believes to be derived from injured tooth buds are certainly not teeth that have been cracked and split later as Cawston claims in his attempt to argue for the non-succession of sharks' teeth. It may be seen clearly in the photographs shown by Gudger (1937) that these have not been split after formation but that actually they represent two small teeth, together approximating the form of a large tooth which they replace. Each is perfectly intact, showing no evidence of late mechanical injury. This of course leaves Gudger's interpretation as to their origin the only tenable one so far set forth.

Other items mentioned by Cawston are mostly minor matters, and may be readily answered, although the direct evidence already discussed should dispose of the matter. One of these minor points raised by Cawston is the finding of barnacles on the front row of teeth of a *Carcharias taurus,* which he takes to indicate that these teeth in the upper and lower jaws do not meet and are permanent. There is no argument on the first statement. If the shark had been feeding vigorously the barnacles certainly could not have prospered. The speed with which some barnacles grow is distinctly startling and is such as to make their presence entirely possible along with the regular loss of teeth. Given a fasting shark, the growth of barnacles on exposed teeth is then purely a question of the relative speeds of the two processes, barnacle growth and speed of tooth succession. The author has personally never seen shark teeth encrusted with barnacles, although he has examined many sharks from the barnacle-infested waters of the Florida west coast and always found them perfectly clean. In this region barnacles on other newly exposed surfaces will make a marked growth in two weeks and in a month be prominent objects. Perhaps it should be looked upon with surprise that more sharks are not found with barnacles on their teeth since certainly a fasting shark is not a rare item, as there are many vicissitudes that could upset their feeding behavior. It should be noted that the sharks referred to were all taken by hook and line, selective to the extent that those fish were feeding at the time caught.

Another item mentioned by Cawston (1938a, 1938b, 1940a) in defense of his proposition is that the first row of teeth are often slightly smaller than the second, third or fourth, et cetera, finally reaching a row where they are again smaller in graded series. Since sharks reach no definite size but grow more or less continuously throughout life at an ever decreasing pace, this is exactly the condition one should expect on a basis of continual tooth renewal. That is, the young teeth in the extreme back rows have not yet reached full size, those just exposed have and are beginning to reach a functional posi-

tion and average the largest, while those anterior to them, formed at an earlier time when the shark was smaller, are not of such size. With even and uniform growth of the fish the largest tooth in any series then should be remote from either end of the entire line from tooth bud to the front tooth. This is close to the condition found, with minor variations perhaps indicative of vicissitudes of feeding and temperature. The exact condition encountered becomes determined then by the relationship between the speed of the growth of the shark and the speed of tooth succession. Of these two rates the latter is at least semi-dependent on the former for when growth is checked for whatever reason all activity based on speed of metabolism is appropriately influenced.

The other points of Cawston's papers are mostly theoretical, based on the premise of the permanency of sharks' teeth and consequently it is pointless to take each one up separately or to discuss the early quotations he uses, which are now of purely historical interest.

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New York Zoological Society, New York.

A Young Angler-Fish, *Lophius piscatorius* Linnaeus

By Theodore H. Eaton, Jr.

THE fish described here (Fig. 1) was taken by the writer at Port Clyde, Maine, August 8, 1937, in a mat of floating *Fucus* which drifted against a dock on the incoming tide. Its measurements (preserved) are as follows:

Standard length	38 mm.
Lower jaw projects beyond upper	2
Caudal fin	12
Total length	52
Head length (to upper jaw)	13
Head width	13
Pectoral fin	18
Pelvic fin	27
Body width behind pectoral girdle	6
Illicium	9

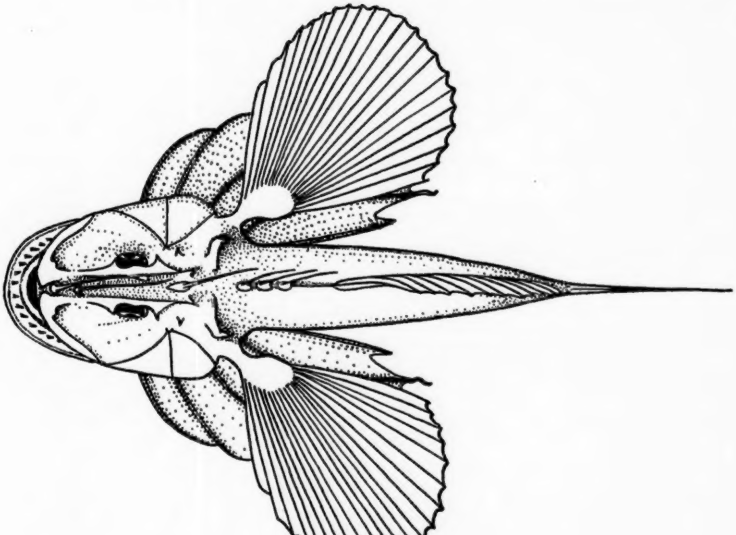

Fig. 1. *Lophius piscatorius*, length 52 mm.

Transferred to a bowl of sea water, the young *Lophius* remained in good condition for several hours and was then preserved. It showed no tendency to seek the bottom, but stayed with its mouth at the surface, swimming slowly. The head was held horizontally, but the body hung down at an angle of 30° – 40°, bending abruptly just behind the head. Agassiz (1882) noted this inclined position in smaller pelagic young of the same species.

Practically all propulsive movements were made by the body and tail, not by the paired fins. Ordinarily this motion was a weak but constant beating of the narrow tail from the posterior half or two-thirds of the body. At intervals, without apparent stimulus, the fish would accelerate for a moment or two, laying the pectoral and pelvic fins back and vibrating the whole body so that it thrust itself partly out of water against the side of the bowl. Then it would rest quietly for a few seconds, spreading the paired fins broadly. The pelvics did not move at all except when drawn against the body at times of vigorous action. The pectorals supplemented the usual movement of the tail by a gentle fanlike undulation, beginning at the anterior edge and carrying back through the fin in six or eight waves. The margins in front beat alternately, left and right. The pectorals stood out approximately in the plane of the body, broadly extended and conspicuous, even to the point of disguising the fish-like form.

This behavior and appearance suggest that the fish had given up an earlier life in open water and was now adapted to concealing itself in floating weed, but that the bottom-dwelling habit of the adult was not even hinted as yet. The broad, relatively motionless paired fins and the separated anterior dorsal rays tended to conceal the form of the fish, so that it was difficult to see unless taken out of the cluster of weed. In this specimen, too, the pectorals were strongly pediculate. Gregory and Conrad (1936) have described the function of pediculate fins in related Antennariidae, which use both pectorals and pelvics to crawl among the branches of seaweed. For structural reasons these authors infer that the ancestry of *Lophius* lies somewhere among the primitive antennariids.

It seems, then, that an ancestral habit of living in floating weed may be reflected in the pediculate fin of *Lophius*, but that the use of these fins for crawling is now wholly impossible on account of their size, shape and delicate structure. Rather they have taken on a new function, camouflage, and the young fish swims slowly, drifting with the weed, until such time as it goes into its third ecological niche, the sea-bottom.

Agassiz (1877, 1882) found pelagic young of *Lophius* up to 30 mm. long at Newport and in Massachusetts Bay during July, August and September. Only in the largest of these had the head begun to broaden and the paired fins to expand appreciably; the pelvics bore long trailing tendrils, and the anterior dorsal rays had not yet reached the adult position, as in my specimen. Younger ones (Fig. 2) had the slender shape of most newly-hatched larval teleosts. Procter (1928) found eggs at Mt. Desert, Maine, on June 29, but was unable to rear the young fish beyond 6-7 mm. length (13 days), while Agassiz reported the eggs common in the latter part of August. This evidence suggests an extended spawning season, and also a probable limit of growth of about 30 mm. in the first summer. The total length of my Port Clyde specimen is 52 mm.; thus it is probably a second-year fish, and has evidently lived in floating weed most or all of the time since the end of the first summer. Günther (1880) figures a young *Lophius* somewhat more advanced; its length is not stated but the illustration (Fig. 210, p. 471) is 70 mm. long, probably the actual size. The pectorals and pelvics are still very large, their rays ending in filaments relatively longer than in my specimen.

The first four dorsal spines behind the illicium carry branched tendrils, and a row of smaller ones has appeared around the lower rim of the head and mouth, as in the adult. The shape of this fish indicates that it probably lived concealed among seaweed and had not yet become benthonic.

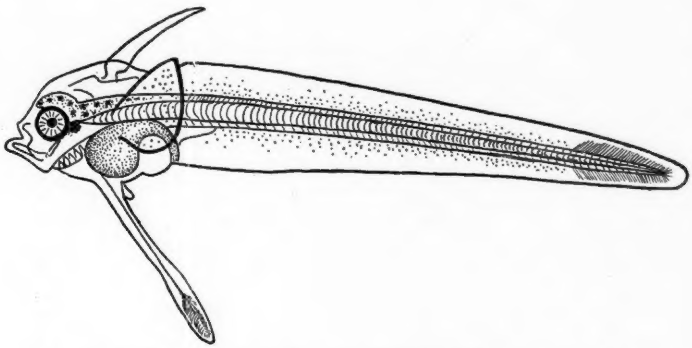

Fig. 2. *Lophius piscatorius,* length 5 mm. (After Agassiz, 1877, pl. II, fig. 9.)

Thus *Lophius* evidently passes through three structural and ecological stages in its postembryonic life:

1. *Primary larva,* of the usual slender form of teleost larvae, but with elongated slender pelvics and a spine (second dorsal of adult) already present on the head; swims in open water.
2. *Secondary larva,* length about 30 to at least 70 mm., with broad head but slender body, characterized primarily by the great broadening of the paired fins and development of filaments and tendrils; hides among floating weed where its form conceals it.
3. *Definitive stage* (*adult*), with both head and body much enlarged but fins reduced; lives on bottom, relatively inactive.

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Cornell University, Ithaca, New York.

Ichthyological Notes

FISH MORTALITY RESULTING FROM EFFECTS OF A TROPICAL HURRICANE.—Widespread mortality in a fish population occasioned by a tropical hurricane is of sufficient interest to be recorded. An unusual series of circumstances in the Savannah River caused the death of a large proportion of the fishes there following the hurricane of August 11, 1940.

The tropical storm was accompanied by winds exceeding 90 miles per hour and by torrential rains. A prolonged dry spell preceded the storm and the river was at a low stage and the adjacent swamps were dry. The storm center followed essentially the valley of the Savannah River between Georgia and South Carolina.

Green leaves of vegetation in the marshes were blown off or stripped and lashed into narrow shreds. Many of the hardwood trees were denuded of leaves and these with ground litter were eventually washed into the Savannah River by the ton. The waters of this river are usually muddy, but about August 12, 1940, the water became clear. On the day following the river water became black and many fishes were seen on the surface gasping for breath. This condition was observed for many miles along the Savannah River and upstream far above tidal water influences. On August 14, 1940, the situation had become much more acute and many thousands of fishes were seen floating dead downstream with the tide or were washed ashore.

The fishes represented included catfish (Ameiuridae), largemouth bass (*Huro salmoides*), and other centrarchids, eels (*Anguilla bostoniensis*), rock fish (*Roccus saxatilis*), long and short nosed sturgeon (*Acipenser* sp.), flounders (*Paralichthys* sp.), and soles (*Trinectes maculatus fasciatus*). The flounders and soles were by far the most numerous among the dead fish.

Several small flounders and soles, alive and gasping on the surface, were scooped into a pail of water, where they continued to gasp at the surface. After the water was stirred by hand to aerate it they immediately disappeared from the surface They were again placed in the river and shortly reappeared gasping on the surface. This experiment was repeated several times with the same results.

Since these rough tests indicated an oxygen deficiency, samples of the water were taken by standard methods for oxygen analysis by workers of the United States Public Health Service, Malaria Control Laboratory, at my request. Two samples were taken at and near the surface of the river opposite the city of Savannah, Georgia. These showed 1.6 p.p.m. of oxygen at a temperature of 28° Centigrade on August 19, 1940. They were taken at a point where flounders, soles, eels, and catfish were gasping and dying at the surface.

A chemical concern in Savannah, Georgia, made an analysis of the water taken from the river on August 19, 1940, but they did not test for oxygen. Their analysis from three locations near Savannah is given below:

Test	Sample 1	Sample 2	Sample 3
Organic Matter	80. p.p.m.	72. p.p.m.	64. p.p.m.
Inorganic Matter	56. p.p.m.	60. p.p.m.	68. p.p.m.
Total Solids	136. p.p.m.	132. p.p.m.	132. p.p.m.
Chlorine	12.6 p.p.m.	22.7 p.p.m.	6.3 p.p.m.
pH	7.3	7.2	7.2
Sulphides	0.0 p.p.m.	0.0 p.p.m.	0.0 p.p.m.
Sulphites	0.0 p.p.m.	0.0 p.p.m.	0.0 p.p.m.

A test was also made for tannic acid and this showed less than 1 p.p.m for each of the three locations where samples were taken.

From the evidence submitted the mortality of the fishes can be explained most satisfactorily as due to oxygen deficiency. The green leaves had decomposed, oxidized, and depleted the waters of oxygen.

Other factors, such as salt water, chemical pollution from industrial companies, barometric pressure and release of dissolved gas, have been suggested as a possible cause of the biological disaster. However none explain satisfactorily the wide-spread mortality

of the fishes throughout more than 40 miles of the lower stretches of the Savannah River on the dates previously listed.

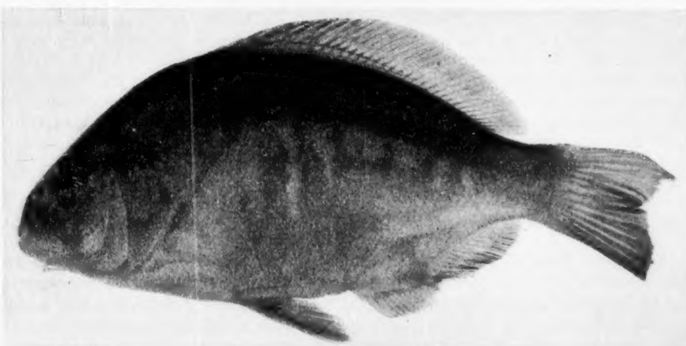
It was predicted on August 15, 1940, that the mortality of the fishes would cease when well-aerated waters from the Piedmont sections of Georgia and South Carolina reached the coastal area. Flood waters ordinarily take 9 to 10 days to reach the Savannah, Georgia, point on the Savannah River from the Augusta, Georgia, location in the Piedmont. As predicted the situation corrected itself when flood waters reached the coastal area. A water sample taken on August 21, 1940, after flood waters reached Savannah, showed a dissolved oxygen content of 7.3 p.p.m. at a temperature of 28° C.

Certain species of fish in the lower reaches of the Savannah River were virtually exterminated. Fishermen have had almost no success in the Savannah River during the year following the hurricane.

Gars (*Lepisosteus osseus*), carp (*Cyprinus carpio*) and several species of cyprinodonts, were not affected by the hurricane. This, of course, would be expected upon consideration of their tolerance to low dissolved-oxygen conditions.—EDWIN P. CREASER, *U. S. Fish and Wildlife Service, R. D. 1, Savannah, Georgia.*

ANOTHER ABERRANT COLOR-PHASE OF *AMPHISTICHUS ARGENTEUS*.—In a previous note I have mentioned the fact that *Amphistichus argenteus* Agassiz (in typical coloration conspicuously marked with vertical brassy-olive bars alternating with vertical series of spots of the same color, upon a silvery background) occurs in an apparently mutant unicolored phase (COPEIA, 1936 (2): 117).

It now appears that there is another aberrant color-phase—apparently intermediate between these two—in which the entire back and sides are brassy-olive, interrupted only by a few irregular vertical streaks of silver upon the sides.



Aberrant color-phase of *Amphistichus argenteus*
Bolinas Bay, Marin County, California

Thus far, I have obtained three specimens of this apparently intermediate coloration. Two of these, taken April 16, 1939, in the surf at Bolinas Bay, 300 yards southwest of the inlet of Bolinas Lagoon, Marin County, California (37° 54′ 17″ N. Lat., 122° 40′ 56″ W. Long.), are deposited in the Museum of Zoology at the University of Michigan under catalog no. 126221. One of these specimens is a male, 153.5 mm. in standard length, and is shown in the accompanying photograph kindly provided by Dr. Hubbs. He has observed a further peculiarity in the other of these two specimens (a female, standard length 141 mm.) in that the anal fin contains 4 spines instead of the usual 3. The third specimen (a male, standard length 183 mm.), taken July 17, 1938, at Muir Beach, Marin County, California (37° 51′ 30″ N. Lat., 122° 34′ 35″ W. Long.), is deposited in the Natural History Museum at Stanford University under catalog no. 33441.

Since Dr. Hubbs has noted that there are no authentic records of *Amphistichus argenteus* north of San Francisco (Proc. U. S. Nat. Museum, 82 (2962), 1933: 5) it should be mentioned that the two specimens from Bolinas Bay do not now constitute the northernmost record of the species. On August 29, 1937, I obtained 3 typical specimens of *Amphistichus argenteus,* ranging from 117 to 127.6 mm. in standard length, in the surf at Bodega Bay, Sonoma County, California (38° 18′ 48″ N. Lat., 123° 02′ 05″ W. Long.). Later the same day I obtained 5 more, 128 to 216 mm. in standard length, from the tip of the sandspit at the inlet of Bodega Lagoon (38° 18′ 22″ N. Lat, 123° 03′ 18″ W. Long.). These two series have been deposited in the Natural History Museum at Stanford University under catalog nos. 33415–33417 and 33418–33422, respectively.— W. I. FOLLETT, *Central Bank Bldg., Oakland, California.*

ALLIGATOR GAR FEEDS UPON BIRDS IN TEXAS.—Few records of the food of the alligator gar, *Lepisosteus spatula* Lacépède, based upon stomach examinations have been published. Bonham studied the food of gars in Texas (Trans. Am. Fish. Soc., 70, 1940: 356–362) and found food in only 3 out of 21 alligator gar and these had fed on fish. The empty stomachs are mostly the result of regurgitation in seined specimens and to digestion among those captured in trap nets. Samuel W. Fitzpatrick, an ardent fisherman of Corpus Christi, Texas, and formerly a student at Cornell University, has been successful in angling for alligator gar and has made a number of observations on stomach contents which are recorded below.

Six large alligator gar were caught by angling in Cuartez Resaca, 5 miles northeast of Los Fresnos, Texas, and about 8 miles from the Gulf of Mexico during the summer of 1939. This lake is slightly brackish, and while it is approximately 25 miles long it is only 25 to 75 yards wide. An examination of the stomach contents was made in the field and unfortunately they were not saved for more specific identification in the laboratory. Four of the gar had food in the stomach and in each the remains of rather large birds were present. On one occasion a large alligator gar was seen to swallow a water turkey, *Anhinga anhinga,* which was roosting on a stick a few inches above the water. At other times live decoys used in duck hunting were swallowed and several ducks were shot but disappeared into the mouths of these voracious creatures before they could be retrieved. Freshly killed grackles make good bait when angling for alligator gar. It seems that this fish must be of considerable importance as a predator upon ducks and other water-loving birds in the southern rivers and swamps of the lower Mississippi River and Gulf of Mexico drainages where it sometimes occurs in large numbers.—EDWARD C. RANEY, *Department of Zoology, Cornell University, Ithaca, New York.*

THE NAME OF THE WARMOUTH.[1]—The earliest available name of this centrarchid (currently known as *Chaenobryttus gulosus*) is *Cyprinus coronarius* Bartram (Travels, 1791: 153). The accompanying common name is "yellow bream or sun fish." The description is detailed and unmistakable; in fact, it is one of the best descriptions we have of the colors of this fish in life. As to validity, the name fulfills every requirement of Article 25 of the International Rules of Zoological Nomenclature. It antedates by thirty-eight years the *Pomotis gulosus* of Cuvier (in Cuvier and Valenciennes, Hist. Nat. Poissons, 3, 1829: 367). Accordingly, the warmouth may be known hereafter as *Chaenobryttus coronarius* (Bartram). The type locality is Lake Dexter or vicinity, Volusia County, Florida.

This determination of Bartram's name is corroborated by his drawing ('Tab[a]. VII') of the "Yellow Bream or Old Wife," which is preserved in the British Museum and is accompanied by descriptive notes. This drawing may be considered to represent the type specimen.

For advice and assistance I am much indebted to Mr. Henry W. Fowler, of the Academy of Natural Sciences of Philadelphia.—FRANCIS HARPER, *Swarthmore, Pennsylvania.*

[1] Investigation supported by the John Bartram Association and aided by a grant from the Penrose Fund of the American Philosophical Society.

BASKING SHARK ON THE WASHINGTON COAST.[1]—Schultz and DeLacy (Journ. Pan-Pacific Research Inst., 10 (4), 1935: 367) state that while the basking shark, *Cetorhinus maximus,* has been recorded from northern British Columbia there are no definite records from the southern part of the Province or from Washington and Oregon. The writer has seen two specimens of the species on the Washington coast in recent months.

The first specimen was a female, 17.5 feet in total length, taken on August 13, 1940, near Mukilteo on Puget Sound. The shark, with two or three other large sharks, had been seen for several days swimming about at the surface in this vicinity. On this day it was harpooned by some men from a rowboat and landed after a battle lasting four and one-half hours.

The second specimen was a male, approximately 28 feet in total length, which drifted in dead on the open ocean beach a little north of Copalis Beach, Washington, on or about March 14, 1941. This specimen illustrated how stories of sea serpents get started along this coast. A man one morning came to my cabin and excitedly told me that a monstrous sea serpent 40 feet long with the head of a horse and the body all covered with hair had been cast upon the beach dead and would I please come look at it before they called the newspapers. I found the specimen in rather poor shape from having rolled about in the surf on the sandy beach. All the skin and most of the flesh was gone from the head, leaving a structure that remotely resembled a horse's head but was entirely cartilaginous, bore the tiny teeth of a basking shark, and was backed by the enormous gill slits and long dense gill rakers of this shark. The skin had been so abraded by the sand that it hung in short filaments all over the body and it did give a good resemblance, from a distance, of a coat of gray hair.—WILBERT MCLEOD CHAPMAN, *United States Fish and Wildlife Service, Seattle, Washington.*

[1] Published with the permission of the Director, U.S. Fish and Wildlife Service.

Herpetological Notes

A RECORD OF *GRAPTEMYS PSEUDOGEOGRAPHICA VERSA.*—A turtle in the University of Rochester collection (UR 6335) extends the known range of *Graptemys pseudogeographica versa* Stejneger. This specimen agrees in the character of the postocular mark with Stejneger's description (1925, Jour. Wash. Acad. Sci., 15: 463), which was based on eight specimens from Austin, Texas. The present specimen was collected by S. C. Bishop, April 2, 1936, 3 miles southeast of 700 Springs, on the South Fork of the Llano River, northeastern Edwards County, Texas, about 130 miles due west of Austin. I know of no additional specimens or published records of this turtle.—ANITA E. DAUGHERTY, *Dept. of Zoology, University of Rochester, Rochester, New York.*

WESTERNMOST RECORD OF *EUMECES MULTIVIRGATUS.*—A specimen of lizard in the University of Rochester collection (UR 5389), collected 15 miles north of Topock, Mohave County, Arizona, May 2, 1936, by S. C. Bishop, is identifiable as *Eumeces multivirgatus* (Hallowell). Previous Arizona records given by Taylor (1936, Univ. Kans. Sci. Bull. 23: 351–353) are from three localities in Coconino County: Grand Canyon, Flagstaff, and near Mt. Elden (northeast of Flagstaff). A fourth locality, "Elder Mt.," given by Taylor for a specimen in the L. M. Klauber collection is, according to information received from Mr. Klauber, apparently a misprint for Mt. Elden. Specimens in the Klauber collection contribute further Coconino County localities: near J. D. Dam (south of Williams) and near McDougal Spring. The Topock specimen extends the range to the west.—ANITA E. DAUGHERTY, *Department of Zoology, University of Rochester, Rochester, N. Y.*

AN EGG CLUSTER OF *ANEIDES FERREUS*.—A female of *Aneides ferreus* Cope, with a cluster of nine eggs in an advanced stage of development was taken on Aug. 16, 1941, near Patrick Creek, Del Norte Co., California, about 16 miles south of the Oregon line, at an altitude of 2000 feet. The salamander was found "alongside of eggs under bark of fallen Douglas fir." Eight of the eggs are still attached separately to a bit of the bark after their arrival in Philadelphia. So close together are the attachments that most of the eggs are in contact. The eggs measure approximately 6 mm. in diameter, and the pedicles are 4 mm. long.

The unattached egg was opened. It had two capsules, and contained a fully formed young with the yolk sac still partly protruding from the stomach. There was a single large, flat, leaflike, allantoic gill on each side. As the animal was coiled, one lobe of the gill extended over the eye, one almost over the hand, and the third part way back over the body. The young animal was approximately 15 mm. long.

I am much indebted to my colleague at the Philadelphia Academy of Natural Sciences, Mr. J. A. G. Rehn, and to his son Mr. J. W. A. Rehn, who collected the material.—E. R. DUNN, *Academy of Natural Sciences, Philadelphia, Pennsylvania.*

A NEW NAME FOR A CHINESE SNAKE.—*Tropidonotus dorsalis* was described in 1864 by Günther (Rept. Brit. India: 263) from Chekiang, China. The species remained in that genus until 1893, when Boulenger placed it in *Pseudoxenodon* (Cat. Snakes Brit. Mus., 1: 271), where it has since remained (Pope, Reptiles of China, 1935: 143). The specific name cannot stand, however, for during the thirty years it remained in *Tropidonotus,* an older *dorsalis* (*Eutaenia dorsalis* Baird and Girard, Cat. N. Amer. Rept., 1853: 31, from Mexico) was referred by Jan in 1865 to *Tropidonotus* (*Tropidonotus sirtalis dorsalis* Jan, Arch. Zool. Anat. Fis., 3: 204, 211), to which genus European authors since then have generally referred it and its relatives (Werner, 1929, Zool. Jahrb., Syst.: 11). Boulenger treated it as a synonym of *Tropidonotus ordinatus sirtalis* (*op. cit.*: 207).

Since the name *dorsalis* of Günther (1864) is suppressed as a homonym of *dorsalis* of Baird and Girard (1853), another name must be used for the Chinese snake. I suggest the name *Pseudoxenodon* **nothus** (Latin, of mixed or bastard breed or kind; illegitimate), in reference to the dubious, hybrid-like character of the type of Günther's species (see Pope, *op. cit.*: 144).—HOBART M. SMITH, *U.S. National Museum, Washington, D.C.*

A NEW RECORD FOR *EURYCEA LUCIFUGA* IN OKLAHOMA.[1]—On April 14, 1941, nine specimens of *Eurycea lucifuga* Rafinesque were taken from caves 13 miles northeast of Fort Gibson in Cherokee County, Oklahoma. The larger of the two caves visited is on a hill about half a mile south of highway U.S. 62, T. 16 N., R. 21 E., S. 36. This cave consists of a vertical 60-foot shaft at the bottom of which is a room with a long corridor extending horizontally to another vertical shaft which is about 13 feet deep. Six salamanders were taken among decaying leaves on a ledge about 20 feet from the entrance. None were found in the deeper portions of the cave.

The smaller cave is approximately 200 feet north of the highway and is merely a tunnel about 75 feet long. Due to the fact that the roof has fallen in two places, the passage is easily accessible. The tunnel floor is only about 7 feet from the ground level. Many specimens were seen in horizontal crevices near the mouth where three *Eurycea lucifuga* and one *Eurycea melanopleura* were taken.

The only published record of *Eurycea lucifuga* from Oklahoma appears to be that of Ortenburger (1929, COPEIA, 170: 26) who reported it from Delaware County, 4 miles southwest of Grove.

The specimens here reported agree in most respects with Dunn's description of the species (1926, Salamanders of the Family Plethodontidae: 338). Melanophores, not mentioned by Dunn, are numerous on the underparts of the head. The parasphenoid series, described as "beginning in two patches at level of hind edge of eye socket," in the Cherokee County specimens extend backward from a point slightly posterior to the middle of the eye socket. The length of the inner arm of the vomerine series is about twice its distance from the parasphenoid series.—GEORGE A. MOORE and WILLIAM J. CARTER, *Oklahoma Agricultural and Mechanical College, Stillwater, Oklahoma.*

[1] Contribution No. 93 from the Zoological Laboratory, Oklahoma Agricultural and Mechanical College. The writers are indebted to Mr. A. M. Hieronymus of Perkins, Oklahoma, for information regarding the caves.

THE FIRST EDITION OF HOLBROOK'S NORTH AMERICAN HERPETOLOGY. —When Theodore Gill reported the discovery by Witmer Stone of a fourth volume of the first edition of Holbrook's *North American Herpetology* in the library of the Academy of Natural Sciences in Philadelphia, the copy in that library was thought to be the only one known (Gill, 1903, Science, 17: 910). Gill, in his memoir on Holbrook in the previous year, had reported the first edition to consist of only three volumes (1902, Nat. Acad. Sci. Biogr. Mem., 4: 56). A second set of the first edition of the *North American Herpetology*, complete with the fourth volume, was reported by the late Dr. Bohumil Shimek in 1924 (Proc. Acad. Sci. Iowa, 31: 427). Thus there appeared at that time to be only two published records of the supposedly especially rare fourth volume of the first edition. It may be added that the impression that the first edition consists of only three volumes, established by the publisher's prefatory note in the second edition, is perpetuated by the biography of Holbrook in the *Dictionary of American Biography*.

The acquisition of a complete set of the first edition of Holbrook's work by Field Museum thus offers an appropriate occasion for further remarks on this noteworthy item of bibliographic history. Enquiry from my colleagues discloses the existence of a total of nine four-volume sets of the first edition, (Academy of Natural Sciences, Library of Congress (2), Museum of Comparative Zoology, Carnegie Museum, California Academy of Sciences, Charleston Museum, Field Museum, and the private library of Thomas Barbour). The question thus arises as to whether three volume sets of this edition are more numerous than are complete ones. Gill's remarks indicate that such sets are known; but the only three volume sets I discover are one at the University of Michigan, one at the University of Iowa, and one in the library of Charles L. Camp. To judge from the non-appearance of odd volumes or of three-volume sets of the first edition in the catalogues of book dealers, the first edition is rare in all of its volumes. It does not appear that there is any complete set of the first edition in European libraries.

The fourth volume of the set here reported was found to agree exactly with the data supplied by Shimek, and on enquiry from the library at the University of Iowa, our set proves in fact to be the one long in his possession. It is gratifying to have it find a permanent place in a library especially rich in the literature of herpetology.

The history of the first edition of the work, set forth by Gill on the basis of verbal information, is still far from clear. He states, on the authority of the artist Richard (one of many employed by Holbrook) that "He would become dissatisfied with a work before its completion and would have new plates drawn and published. Then he would offer to substitute the new for the old numbers, and, I was told, might even decline to let an old subscriber have a copy of the new edition unless the old one was returned to be destroyed."

Holbrook's work on the two editions of the *North American Herpetology* was carried on at his home in Charleston, South Carolina, and the work was presumably distributed from his home. In my own recent reference to Holbrook's destruction of his first edition (Schmidt and Davis, Field Book of Snakes: 12) the scene of the burning is placed in his "Philadelphia backyard," by a *lapsus calami,* arising perhaps from association of ideas with its place of printing, and to a confused recollection of the destruction of the plates of Holbrook's later work on fishes by a disastrous fire in Philadelphia.

A copy of volume five of the second edition that accompanies our set of the first edition exhibits numerous differences from another copy in Field Museum's set of the second edition, especially in its plates. The text differs only in that page 11 has been reprinted to add Holbrook's name to *Bufo erythronotus* and page 97 to add an NB acknowledgment to the artist. There is also an unnumbered page of errata for the first four volumes (which prove to refer to the second edition). Our first copy of volume five has an inserted errata slip for volume five only, and an NB slip noting Holbrook's supposition that *dekayi* and *occipitomaculata* are identical. It is evident that the copy of volume five received with the first edition considerably antedates the other.

More noteworthy differences consist in the fact that plate 13 is by Queen, plate 16 has the error in the specific name *belineata* corrected to *bilineata,* plates 19 and 26 are by Hill, plate 32 lacks any signature, and plate 37 is by Richard. In the later copy of volume five, plates 13, 19 and 26 are by Richard, plate 32 (redrawn) bears the artist's name Phiel (Peele in the text) and plate 37 is by Hopkins. Plates 13, 16, 19 and 26 of the earlier copy are identical with plates in the first edition; plates 32 and 37 are orphans, not represented in the first edition, and replaced by others in the second. Thus

discrepancies of a similar nature between individual volumes and sets of Holbrook's work in both editions are to be expected. I am much indebted to Mrs. Eunice Gemmill, Assistant Librarian at Field Museum, for aid in collating our set of the first edition and our two copies of volume five of the second.—KARL P. SCHMIDT, *Field Museum of Natural History, Chicago, Illinois.*

THAMNOPHIS ANGUSTIROSTRIS IN TEXAS.—The brown-spotted garter snake, *Thamnophis angustirostis* (Kennicott), is currently known from the Mexican plateau, north of Durango, to central and southeastern Arizona, and southwestern New Mexico (Ruthven, 1908, Bull. U. S. Nat. Mus., 61: 121; VanDenburgh, 1922, Occ. Pap. Calif. Acad. Sci., 10: 857; Stejneger and Barbour, 1939, Check List N. A. Amph. Rept., Ed. 4: 133).

Through the interest of Dr. A. H. Wright, the Cornell University Museum has received from Mr. Philip Harter of Palo Pinto, Texas, several miscellaneous collections of reptiles. Among these is a snake taken along the Brazos River near Palo Pinto in September, 1938, which proves to be *Thamnophis angustirostris,* extending the range of the species about 600 miles eastward in the United States, and constituting the first record for the species in Texas. The specimen (C.U.M. 2383) is a mature male 581 mm. in length, of which the tail comprises 27.7% of the total. The ventrals are 176, subcaudals 78 (perhaps two scales are missing from the tip of the tail), anal entire, upper labials 8, lower labials 10, preoculars 2, postoculars 3, scale rows 21, 19, 17. The coloration is about as in specimens from Arizona, the dorsum being uniform brownish with faint indications of spots, while the belly is clear but for the accumulation of a little dark pigment along the anterolateral borders of the ventrals.—HAROLD TRAPIDO, *Laboratory of Zoology, Cornell University, Ithaca, New York.*

ESTABLISHMENT OF *ANOLIS CAROLINENSIS* IN KANSAS.—In the course of a survey of the biotic conditions at Fort Leavenworth, Kansas, during July, 1940, a lizard was brought to me in a tin can by some boys who claimed to have killed fifteen others of the same kind in the thickets along the bank of the Missouri River. This lizard proved to be *Anolis carolinensis* Voigt. It is now specimen number 21450 in the Museum of Birds and Mammals, University of Kansas.

I inquired around the neighborhood concerning these lizards, and found that a family had been sent two dozen of them from some place in North Carolina during the summer of 1938. They were kept until some time in August and then were released near the Missouri River. It is certain that some of these anoles passed the winter successfully, and they may be established along the Missouri River at Fort Leavenworth and Leavenworth, Kansas.—MALCOLM J. BRUMWELL, *Museum of Birds and Mammals, University of Kansas, Lawrence, Kansas.*

MATING BEHAVIOR OF THE NORTHERN ALLIGATOR LIZARD.—Vestal (COPEIA, 1940: 51) recently recorded and figured the posture assumed by mating alligator lizards (*Gerrhonotus coeruleus*). On the morning of April 6, 1940, I made detailed notes on the mating behavior of a pair of northern alligator lizards (*Gerrhonotus coeruleus principis* Baird and Girard) in copulation just outside Seattle, Washington. The position assumed by this pair was exactly like that pictured by Vestal. The lizards were in thick underbrush, and hence were able to separate and escape when first approached. When they reappeared after some time they went through the following mating pattern. The male searched for the female by thrusting out his tongue. As he approached her he made a series of short sharp sidewise jerks of his head and neck. These jerking movements against the dry leaves made a staccato sound. The male then seized the female by the tail and attempted to throw his body around her so that the two cloacas would approximate each other. Being unsuccessful in this attempt he then secured a firm grip on the base of her head and neck with his teeth, at the same time emitting a subdued hissing sound caused by the exhalation of a deep breath. After securing his grip the male threw his left foreleg over the body of the female and bent her body into a letter "C." With his hind legs he moved her body over his and placed their ventral sides together so that the two cloacas were opposite each other. Copulation evidently persists for a long time, for these two animals were still in a clasped position the next day.—ARTHUR SVIHLA, *University of Washington, Seattle, Washington.*

TECHNIQUE FOR SECTIONING SMALL SKULLS.[1]—Because of a mounting interest of the vertebrate paleontologist in the internal morphology of the vertebrate skull, it has become necessary to devise a technique by which serial sections of recent skulls may be made. The procedure which follows below has been used successfully by the writer to section the skulls of recent lizards. It is probably equally well adapted for the sectioning of the skulls of birds and small mammals. Material preserved in alcohol or formalin is satisfactory.

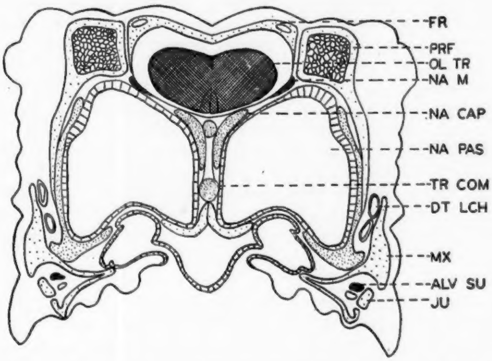


FIG. 1. Cross section through posterior level of the nasal capsule of *Cnemidophorus gularis*. $\times$ 15.

FR, frontal; PRF, prefrontal; OL TR, olfactory tract; NA M medial nasal nerve; NA CAP, medial walls of nasal capsule; NA PAS, nasal passage; TR COM, trabecula communis; DT LCH, lachrymal duct; MX, maxillary; ALV SU, superior alveolar nerve; JU, jugal.

Step 1, *decalcification*: carried out by means of a solution of 5% nitric acid in 10% formalin. A period of at least a month, and preferably two months, is necessary to insure complete removal of bone. For the first two weeks the solution should be changed daily, after that at intervals of three or four days.

Step 2, *washing*: overnight in running water.

Step 3, *dehydration*: the skulls should be placed for 24 hours in each of the following solutions of ethyl alcohol: 30%, 50%, 75%, 95% and absolute. Dioxan has also been used successfully, in which case solutions of 50% and absolute dioxan may be used. The skulls should remain in each solution for three days, and the solutions should be changed daily. Dioxan has the advantage over alcohol that it does not harden the skulls as do the higher grades of alcohol.

Step 4, *clearing* and *infiltration*: for small skulls, i.e., less than 15 mm. in length, if the animals have been dehydrated with alcohol, they should next be placed in a solution of equal parts alcohol and xylol, and thereafter in xylol for 24 hours in each solution. Preliminary infiltration is accomplished by a solution of equal parts xylol and paraffin, in a 36° C. oven for twelve hours, and final infiltration in a solution of Biloid (or some other imbedding paraffin) in a 56° C. oven for another twelve hours. The solution should be changed at least twice in the 12 hour period to insure best results.

If, on the other hand, dioxan has been used in dehydration, the skulls should be placed from pure dioxan into a solution of dioxan and paraffin overnight for preliminary infiltration, and into pure paraffin for twelve hours for final infiltration.

For larger skulls, up to 3 cms. in length, a different procedure is advisable. From either absolute alcohol or dioxan, the skulls should be placed in a solution of equal parts of it and ether for 24 hours. Then the skulls may be transferred to a 2% solution of guncotton in equal parts ether and absolute alcohol. The length of time in this solution is dependent upon the size of the skull, but three to five days is generally sufficient. From the guncotton solution, the skulls are transferred to chloroform for six hours, and then to white oil of thyme for the same length of time. Infiltration is accomplished in a

[1] Acknowledgment is made to the Field Museum and the Museum of Comparative Zoology for the material used, and to Dr. Sylvia Bensley and Miss Louise Warner for aid and advice on the methods involved.

mixture of oil of thyme and paraffin for six hours at 36 degrees, and pure paraffin, which should be changed at least three or four times and preferably more for large skulls, at 54 degrees for twelve hours. Care should be taken to remove all traces of oil of thyme.

Step 5, *imbedding*: small paper boxes are made up, their size dependent upon the size of the skull, which are filled with melted paraffin. The skulls should be transferred to these boxes by forceps which previously have been placed in the paraffin oven. After a slight film forms on the surface of the paraffin, the boxes should be placed in cold water to insure rapid cooling and to prevent crystallization of the paraffin.

After the skulls are imbedded, serial sectioning may proceed according to the common techniques noted in any textbook of histology. Staining will vary according to the technician and the structures which he wishes to observe. For general purposes it has been found suitable to use the common hematoxylin and eosin stain. Iron hematoxylin and copper-chrome hematoxylin have been used and work moderately well. The silver stains require too nice a technique to be of great value. Thickness of sections will vary according to the individual; the writer has found fifteen microns suitable.

A secondary problem which has come up is that of cover glasses. Most cover slips used in this country are imported from Germany, a source which is now shut off. Substitutes have been devised, among them a plastic (distributed by the General Biological Supply House of Chicago), iso-butyl methacryllate, and mica. The latter have been found most satisfactory and may be obtained from Eugene Munsell & Co., 200 Varick Street, New York City.—ERNEST PAUL DUBOIS, *Walker Museum, University of Chicago, Chicago, Illinois.*

A NEW LOCALITY RECORD FOR THE MOUNT LYELL SALAMANDER.—*Hydromantes platycephalus* Camp has been reported heretofore from only nine localities, all in the Sierra Nevada of California. On June 15, 1941, I found an immature individual of this species near the water tank on Bald Mountain, Fresno County, California, elevation 7830 feet. This specimen is now number 35050 in the collection of the Museum of Vertebrate Zoology at the University of California, Berkeley. This constitutes the tenth known locality for the species. The salamander was found under a flat granite boulder about 30 feet below the lower edge of a melting bank of snow. Water from the melting snow kept the sand beneath the rock damp but not wet. Small streams flowed over the granite surface of the mountain within a few feet of the boulder where the salamander was found. The dome-like top of Bald Mountain is practically barren of trees over an area of about 3 acres, but the forest of western white pine (*Pinus monticola*) and Jeffrey pine (*Pinus Jeffreyi*) encroaches to about 50 feet from the local habitat of the salamander.—LOWELL ADAMS, *O'Neals, California.*

THE LONG-TOED SALAMANDER ON VANCOUVER ISLAND.—In British Columbia the long-toed salamander, *Ambystoma macrodactylum* Baird, is known to occur on the mainland at least as far north as the Stikine River (Slevin, 1928, Occ. Pap. Calif. Acad. Sci., 16: 30). This species has recently been recorded from Vancouver Island from a single specimen collected at Forbidden Plateau in 1930 (Brown and Slater, 1939, Occ. Pap. Coll. Puget Sound, 4: 24). The presence of this salamander on Vancouver Island has been further verified by the writer by the taking of eggs, larvae and metamorphosing individuals from a pond near Langford Station, 8 miles northwest of Victoria, during the spring and summer of 1941.

Freshly spawned eggs taken from this pond on March 9 and kept at the museum hatched about March 30, but the larvae were lost by accident before they could be identified. It is presumed, however, that these were *A. macrodactylum* since no other species of salamander was found in the pond. Later, during May, and again in July, advanced larvae were collected from the same pond. A number of these underwent metamorphosis during the third week of July making it possible to identify the species positively.

Measurements in millimeters of metamorphosing larvae and newly-transformed young were as follows:

	Larvae		Metamorphosed young			
Snout to gular fold	....	....	7.0	7.0	7.0	7.4
Gular fold to anus	....	....	16.5	16.5	16.5	19.0
Snout to anus	22.0	19.5	25.5	23.5	23.5	26.2
Anus to tip of tail	17.5	13.0	13.0	17.5	17.0	17.0
Width of head	6.5	6.5	5.5	5.5	5.5	6.0

—G. CLIFFORD CARL, *Provincial Museum, Victoria, British Columbia.*

REVIEWS AND COMMENTS

SYSTEMATIC CATALOGUE OF THE FISHES OF TORTUGAS, FLORIDA, WITH OBSERVATIONS ON COLOR, HABITS, AND LOCAL DISTRIBUTION. By William H. Longley, edited and completed by Samuel F. Hildebrand. Carnegie Institution of Washington Publication 535 (Papers from the Tortugas Laboratory, 34): xiii + 331 pp., 34 pls., 1941.—The late Dr. Longley was, without any doubt, more familiar with the members of a great tropical marine fish-fauna, under water in its living state, than any other man. To the inestimable loss of ichthyology and biology in general, he died just as he was at the beginning of the serious collation of his information into a definitive volume. The thankless and wearisome job of putting what notes were left into shape for publication fell upon Dr. Hildebrand and he has done as well as possible under the circumstances. But a few persons, who knew what Dr. Longley really intended to make of this book, will be disappointed. In view of this and the fact that much of Dr. Longley's work was not well known to ichthyologists, it seems best to give a few historical notes.

Dr. Longley began his underwater work on Tortugas fishes about 26 years ago. His interest at that time was chiefly the evolutionary meanings of the colors and habits of tropical reef fishes. This remained the central theme of his researches, but as summer after summer was spent in the diving helmet at Tortugas many other problems came up and were laid aside for elucidation, in connection with the main theme, in one great final monograph.

The long time periods Dr. Longley spent underwater are well remembered by visitors to the Tortugas Laboratory. Frequently the whole morning and a large part of the afternoon were given over to the work, and the men in charge of the air pumps had to be relieved more frequently than the diver. Some of his friends believe that these long underwater sojourns had a great deal to do with Longley's final break in health. In recent years he could not dive so frequently or so long. But these hours on the sea bottom enabled Dr. Longley to become as familiar with the teeming shallow water fishes of Tortugas as a devoted ornithologist becomes with the local birds—an accomplishment that is, I believe, quite without parallel. The rewards were rich.

At first Dr. Longley depended almost entirely on sight identifications, in the common belief of non-systematists that the hoarding of museum specimens is of no particular value. But it gradually became evident to him that the classification of West Indian reef fishes was not in as good a state as he had assumed it to be, and he felt forced to devote an increasing amount of time to pure systematics. Series of specimens were gradually accumulated but Dr. Longley found, he told me, that systematic work was particularly difficult for him. In spite of this, he carried on what must have been, to him, a very laborious succession of taxonomic researches, with quiet and determined energy. It is unfortunate that he had, at this time, no extensive first-hand touch with other working ichthyologists, but his very retiring disposition did not lead him to seek aid. In fact he never admitted that he was a systematist and to the last deprecated his own taxonomic efforts constantly when he had occasion to meet systematic colleagues. The result was that Longley never became really acquainted with systematic methods and procedures that would have helped him greatly and prevented the loss of much energy and a great part of his results. He never learned the necessity of labeling his specimens. When I gently remonstrated with him, he said that he knew the exact piece of coral or stretch of sand from which every specimen came, and that labels were unnecessary. By preference he published descriptions of his new species in a place well nigh inaccessible to systematic ichthyologists (the Carnegie Institution Year Books) and distributed reprints only on special request. He made two extensive trips through Europe to examine West Indian fish types, even those in the most out-of-the-way museums, and after his last one confessed to me that he wished he had waited to make them until after he had studied

systematics well enough to have made better use of these unique opportunities. Longley also went to the East Indies and studied the rich Indo-Malayan reef fish fauna under water, for comparison with his Tortugas results and confirmation of his theories. The collections made on that trip are stored in the National Museum, but I doubt that the specimens are labeled.

Toward the end, however, Longley was well on the way to a real understanding of the systematics of West Indian fishes. He spent long hours at the National Museum, surrounded by his field notes and stacks of manuscript and notebooks full of data on types in European museums. He anticipated many systematic conclusions reached in several recent systematic revisions, and made numerous discoveries in synonymies and relationships that will now have to await rediscovery by patient systematic research. Upon this basis of systematic groundwork he intended to write a really great monograph on the habits and ecology of Tortugas fishes, with the fruits of his years of pondering upon evolutionary problems.

He was struck down in the midst of preparing this book.[1] What we now have is a mere shadow of what he expected to make it. The book contains none of his theoretical results, only a portion of his ecological and habit notes, and lacks even some of the systematic revisions that I know he had completed and intended to include. What happened to this data no one knows. Perhaps a large part of it had never been committed to paper. Dr. Hildebrand says that parts of the manuscript were obviously missing when it was delivered to him.

Even so, Longley's book is by far the finest account of tropical shore fishes that has ever appeared and we are thankful that so much of it has been saved and rendered available through the labors of Dr. Hildebrand. Numerous systematic results of the first order are included, and for a majority of the included species, Longley's notes form the first information we have of life histories. Disappointing though it may be to his friends, the work forms a great monument to the long and careful labors of a very sincere zoologist.—GEORGE S. MYERS, *Stanford University, California.*

PATTERNS AND PROBLEMS OF DEVELOPMENT. By C. M. Child. Pp. ix + 811, 224 figs. University of Chicago Press, 1941. $8.—The zoologist who is interested in animals as a whole, or in particular groups of animals and their especial general biology, is apt to be lamentably unaware of the special forefronts of general biology, particularly if he finished his formalized biological training some time ago. Nor can he be expected to keep up with the hordes of specialized papers in any but his own field. To workers such as this, the only practicable avenues to knowledge of many important modern fields of research are occasional general lectures and articles—or the publication of some great compendious work which gathers the most important data of a subject under one cover. Dr. Child's book is such a work.

The fundamental physiological processes that determine the form of living structures have increasingly engaged the attention of modern biologists, and although many zoologists have deplored the inroads that this and other primarily physiological subjects have made into the teaching of older lines of biology, it is nevertheless perfectly plain that the morphologist who attempts to shut out knowledge of the physiological development of the structures he studies is indeed a hopeless reactionary. Systematists have lately found that they must know something of genetics to understand specific differentiation, and now morphologists (and indeed any who attempt to evaluate the phylogenetic importance of morphological characters) must realize their need of information on the patterns and physiology of development. For, to borrow from Dr. Child, developmental patterns in their most general terms are patterns of graded activities, behavior patterns, in protoplasms of specific genetic constitutions—in other words, patterns of realization of hereditary potentialities in relation and reaction to environmental factors. The implications will be obvious to every wide-awake systematist and morphologist.—GEORGE S. MYERS, *Stanford University, California.*

[1] From what Dr. Hildebrand says in the introduction, it may be that Longley had finally decided to split up his big work and publish the systematic notes separately.

RETURN TO THE RIVER—A STORY OF THE CHINOOK RUN. By Roderick L. Haig-Brown. William Morrow and Company, New York, 1941: 1–248, 1 map and 16 drawings by Charles De Feo. $3.00.—Confound the fellow anyway! He writes too biologically for the layman and too much in the grand manner of the nature-faker for the biologist. His salmon are full of urges and repressions and emotions but they live in a world peopled with Hydropsyche, Callibeatis, euphausids and chironomids. Constitutionally your reviewer objects to that sort of thing. It produces the sort of hybrid that ought to be sterile—but in this case it isn't. In general the biology is sound and provides a very good picture of the life cycle of the Columbia River Chinook salmon. (Incidentally, why was Chinook not capitalized?) Some phases of the conservation program and of the research work on which it is based are interestingly presented. A striking feature of the book is the success of the author's attempt to give the "feel" of life within the waters. An interpretation of this sort can only be anthromorphic but it is pleasing to most other literate anthropoids and is an entirely legitimate literary device. The reviewer's initial prejudice was completely broken down by the time he was half-way through. But the author disappointed us in the end—very, very sadly. For nigh onto 200 pages we anticipated the successful completion of the one experiment that will satisfy my friend A. G. Huntsman of the validity of the Home Stream Theory—and this author took us right up the very last page only to fail in the end. Never shall I forgive him because I fear that never again will that crucial experiment be so close to consummation.—WILLIS H. RICH, *Natural History Museum, Stanford University, California.*

THE THEORY AND TECHNIQUE OF FRESH WATER ANGLING. By John Alden Knight. Harcourt, Brace, and Co., New York, 1940: 1–223, illus. $3.75.—All the books in the world will not make an expert fisherman, but this author gives some very good advice on equipment and general methods, and many valuable little fishing hints. The book is intended for the novice, and, as the jacket blurb says, "it will ease his path and speed his progress." It gives good advice on selecting rods and other equipment. Most of the book is devoted to trout fishing tactics, with various types of tackle, but bass fishing is not neglected. In the discussion of flies he describes famous patterns and tells something of their lore and history. They are a part of the fun of fishing, though the skeptic may claim that even the "exact imitation" flies don't look like any known insect, and a fish which thinks the fancy varieties look like food could be fooled by any bunch of feathers. The author admits that one highly successful angler carriers only one pattern of dry-fly. He, himself, carries enough to keep his fly-box colorful, and the reader will probably follow suit.

Some of the author's theories, notably the famous "Solunar Theory," seem a little too good to be true, and they might not stand up under a thorough scientific analysis, but they are very interesting. It will be just as well if they do not always work, for it will be a sad day for fishing when thermometers, barometers, and astronomical tables remove all the luck.

This book should prove interesting to any angler, and it should be required reading for those aquatic biologists who do not fish; for, after all, the angler and his theories are a part of the trout's environment.—OSGOOD R. SMITH, *United States Fish and Wildlife Service, Stanford University, California.*

CONSERVATION OF RENEWABLE NATURAL RESOURCES: SOME FUNDAMENTAL ASPECTS OF THE PROBLEM. By Raphael Zon *et al.* University of Pennsylvania Press, Philadelphia, 1941: i–iv, 1–200, 39 figs., $2.50—This is a miscellaneous collection of papers by various authors bearing chiefly on conservation as it relates to agriculture. The papers are divided into three groups: first, "The Natural Vegetation of the United States as a Guide to Current Agricultural and Forestry Practice"; second, "Climatic Cycles in Relation to the Theory and Practice of Conservation"; third, "The Administrative Task of Conservation—Private and Public." For a book with such an inclusive title as this it is regrettable that conservation of animal resources was almost completely ignored. Nevertheless, there is a good deal in this book that bears incidentally on animal resources, and the work is a valuable addition to any library on conservation.—L. A. WALFORD, *Stanford University, California.*

FIELD BOOK OF SNAKES OF THE UNITED STATES AND CANADA. By Karl P. Schmidt and D. Dwight Davis. G. P. Putnam's Sons, New York, 1941: xiii + 365 pp., 34 pls., 103 figs. $3.50.—It is a pleasure to a reviewer to praise this book, which is so accurate and so complete, which includes so much of what should be included and which omits so much which should be omitted. It is very nearly a perfect job, doing what was intended to do and very little less or more. It is a pleasure to this reviewer to refute L. C. Cole, who reviewed it in "Ecology" (1942: 125) and who complained of the omission of two species, *Lampropeltis boylii,* which appears under the name *californiae* (an older name) on p. 180, and *Thamnophis megalops,* which appears as *Thamnophis macrostemma megalops* on p. 241. Both the "omitted" species are present and Mr. Cole seems to have reviewed somewhat casually. The present reviewer might easily have fallen into the same error as the "eleven forms described since the appearance of the check list" do not include *Coluber constrictor priapus* Dunn and Wood, but this snake duly appears on p. 125. *Sonora* (p. 197) has been omitted from the Key to the Genera. This genus will key out to section 37, where it may be distinguished from *Opheodrys* by the shorter posterior chin shields and by the color, which is not bright green, and from *Contia* by the undivided nasal plate and the uniform or banded ventrum (in *Contia* each ventral has a conspicuous black anterior border).

A book of this sort is to be judged from two standpoints, the herpetological and the pedagogical, the expert and the tyro. No really serious fault can be found, and the minor criticisms to follow are to be considered due to the custom which holds that no reviewer is worth his salt unless he has found a flaw or a misprint.

The list of snake families is obtained by elevating *all* Boulenger's subfamilies to family rank. This is a very questionable procedure from any standpoint. It might have been just as well done by omitting *all* Boulenger's subfamilies. Actually there are only *four* main groups in the order Serpentes. Experts may argue as to whether various subgroups should or should not be admitted but why foist eighteen apparently equally valid groups on the beginner?

Cole's comment on the use of common names is fairly well taken. The term "garter snakes" is well enough for *Thamnophis,* but "common garter snakes" versus "western garter snakes" demands considerable thought on the part of the herpetologist, and I doubt if the beginner finds it simpler than "*sirtalis* group" versus "*ordinoides* group." And "Arizona vine snake" for *Oxybelis* leaves me gasping.

Palisot de Beauvois, an adult man, in 1799, in the same paper in which he described the genus *Agkistrodon,* described the snake-swallowing-young as having been witnessed by himself within the year (p. 9). This cannot be called a "childhood or otherwise remote recollection."

The identification of the poison gland with the mammalian parotid (p. 37) is exceedingly dubious.

In the treatment of snake bite (p. 41) quoted from Gloyd, there seems too much emphasis on tourniquet and on sterilization, rather than on immediate suction.

In the section on preservation (p. 67) it would have been well to suggest the removal of the gall bladder on the second or third day. For labeling (p. 68) in the field, good paper and a soft (No. 2) pencil might have been mentioned.

Heterodon contortrix (p. 117) is said to strike "always with the mouth closed," but my experience has been that the mouth is frequently widely open.

While the rule given on p. 173 for distinguishing between coral snakes and *Lampropeltis* is correct, it is a pity to give the impression that color will serve, especially at a time when many young Americans may try to apply this rule in the American tropics where the statements are true neither for coral nor for harmless forms.

In the east the ranges of *Natrix rigida* and of *Tantilla coronata* should have been emended to include Virginia, on the basis of published information.

But it will be obvious that these criticisms are relatively trivial.—E. R. DUNN, *Haverford College, Haverford, Pennsylvania.*

Editorial Notes and News

Annual Meetings

The twenty-fifth annual meeting of the American Society of Ichthyologists and Herpetologists will be held in New York City from Tuesday March 31 to Saturday, April 4. Again Mr. F. H. Stoye is generously offering two prizes of $25 each for the best "student" paper in herpetology and in ichthyology to be presented at this year's meetings. The regular sessions will be held at the American Museum and the tentative program includes two symposia: on Criteria for Vertebrate Subspecies, Species and Genera, at a joint meeting with the American Society of Mammalogists, and on Vertical Distributions. Further details are to be found in the regular announcements sent to the Society members.

The annual meeting of the Western Division of the Society will be held at Salt Lake City, June 16–18, in conjunction with the meetings of the American Society for the Advancement of Science. The tentative program is:

June 16
A.M. Symposium on post-glacial changes in the life of the Great Basin, under the joint sponsorship of the A.S.I.H. and the A.A.A.S.

June 17
9:00 A.M. Submitted papers.
11:45 A.M. Business meeting.
2:00 P.M. Symposium on problems of management of trout waters.

June 18
9:00 A.M. Round-table discussion of seasonal behavior patterns of snakes.
1:30 P.M. Submitted papers.

Express Regulations

The Committee on Express Regulations was appointed to study present regulations and to draft recommendations that would simplify and facilitate shipping of live reptiles and amphibians. It was felt that the specifications of the Railway Express Agency requiring that shipping containers "be completely encased in galvanized wire cloth, of not more than ⅓" square mesh, securely stapled at all surfaces" are costly, unnecessary and cumbersome. The Committee has consulted a number of herpetologists and it is their consensus that shipping regulations should be revised to read:

Snakes and Other Reptiles

Must be in wooden boxes, securely nailed or screwed together, made of material not less than ⅝" in thickness when measurements do not exceed 24" in length and 12" in width and height. Material not less than ⅞" in thickness to be used for boxes of greater dimensions.

Harmless and Poisonous Snakes

Boxes in which shipped must conform to the standards prescribed above, and all snakes within the boxes must be securely enclosed in muslin sacks. Apertures in shipping containers must be covered with wire cloth of not more than ⅛" square mesh, securely stapled about openings on both sides of the wood.

All boxes in which reptiles are shipped must be distinctly marked to indicate if poisonous or harmless.

It is the opinion of the Committee that the precaution of placing snakes in muslin bags precludes any necessity for encasing the entire container in metal cloth, since even though a container were partially crushed in transit the snakes could not escape. Railway Express agents have sometimes enforced the current regulations and at other times they have not. It is urged that the revised specifications herein presented be submitted to the General Traffic Manager of the Express Company with the recommendation that they be strictly enforced. Lack of enforcement could result in cancellation of the privilege of shipping live venomous snakes. Furthermore, it is urged that the Express Agency reconsider its present rate (50% above usual rates) in view of the fact that reptiles and amphibians do not require food, water, or other care or attention while in transit.

Before these recommendations are submitted to the Express Agency, members are requested to offer their views, criticism or other information pertaining to shipping regulations.—Committee on Express Regulations.

Announcements

THE remaining reprints of the zoological papers, principally by GARMAN, FEWKES and KINGSLEY, which have appeared in the Proceedings of the Essex Institute of Salem, have been sent to DR. THOMAS BARBOUR for distribution to persons who might be interested in securing copies of these papers for their personal libraries. They will be available as long as the supply lasts upon application to Dr. Barbour, Museum of Comparative Zoology, Cambridge, Massachusetts.

A large number of DR. HUGH M. SMITH'S reprints are available in the Division of Fishes, U. S. National Museum, to those who are interested in the study of fisheries. They may be secured by consulting the bibliography in the Smith Memorial number of COPEIA, and sending to the Division a list of those desired.

MR. WALTER L. NECKER, Natural History Books, 6843 Hobart Ave., Chicago, has on hand a supply of the Reptilia and Batrachia section of the current Zoological Record. Mr. Necker also states that a supply of the Pisces section should reach him soon.

The BERMUDA BIOLOGICAL LABORATORY FOR RESEARCH, INC., has established scholarships for work in Bermuda for a limited number of special investigators. Applications giving an outline of the proposed investigation, the place of proposed study, and the time of stay should be sent to the COMMITTEE ON AWARD, care of DR. COLUMBUS ISELIN, II, Woods Hole Oceanographic Institution, of PROF. ROSS G. HARRISON, Yale University, or of PROF. E. NEWTON HARVEY, Princeton University.

Requests

AN official of the CHINESE GOVERNMENT, with its capital now at Chungking, has asked that there be secured for him whatever fisheries literature is available in order that some start may be made on the rehabilitation of Chinese fisheries after the war. He would be more than glad to receive any form of fisheries literature whether it deals with life history, systematics, or otherwise, which any reader of this notice may be able to spare for transmittal at such time as communications are re-established. These should be sent to SCHOOL OF FISHERIES, University of Washington, Seattle, Washington, and marked plainly as intended for T. CHOW, Chungking.

Such assistance will be a practical and direct way of showing our sympathy with the Chinese. It speaks volumes for their courage and confidence that such preparations should be under way.

The Chairman of the National Research Council Committee for the Maintenance of Pure Genetic Strains has asked DR. MYRON GORDON, Research Associate in Genetics of the Aquarium, New York Zoological Society, to prepare a statement concerning the kinds and location of important stocks of fishes, amphibians and reptiles. Members of the SOCIETY and non-member contributors to COPEIA, are urged to send in a statement concerning the species and the varieties of the cold-blooded vertebrates under their care before the coming annual meeting so the data collected may be discussed at that time. Correspondence should be addressed to DR. GORDON, American Museum of Natural History, New York City.

News Items

IT is reported that the curatorship of fishes in the CALIFORNIA ACADEMY OF SCIENCE, San Francisco, recently vacated through the death of H. WALTON CLARK, has been filled by the appointment of MR. J. R. SLEVIN, who also retains the curatorship of amphibians and reptiles.

DR. LEONARD P. SCHULTZ flew to Venezuela the first week in February in connection with the State Department's project on cultural relations. He is combining this with three months of fish collecting in the Lake Maracaibo district.

LIEUT. MALCOLM J. BRUMWELL, a herpetological contributor to COPEIA, died on Dec. 14, 1941, as a result of wounds received in action in Hawaii.

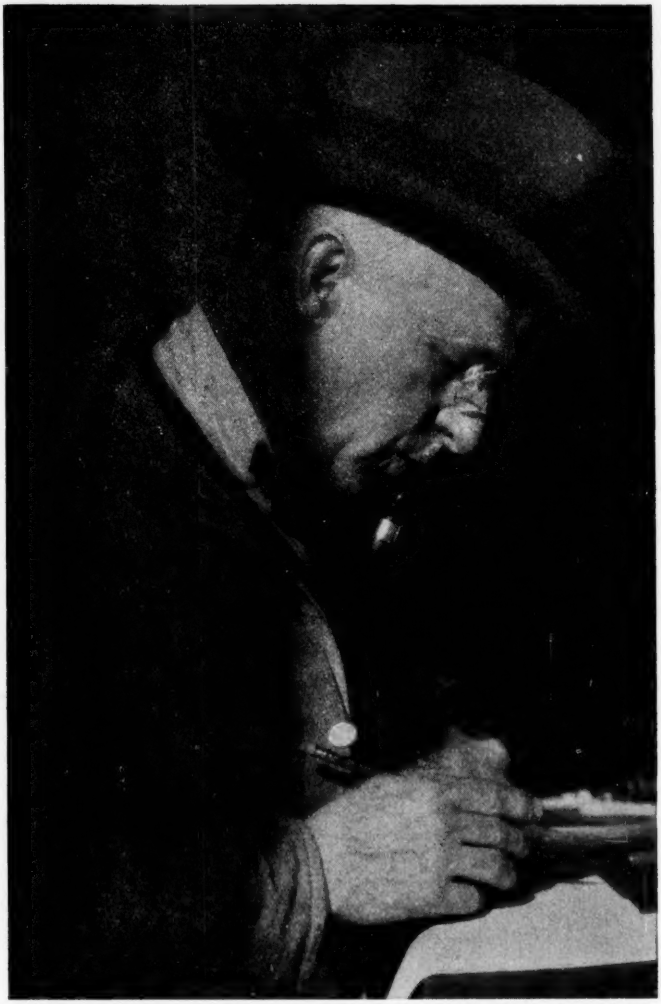


Photo by Dr. Charles Creaser

JACOB REIGHARD, 1861–1942

WHEN an eminent man of science succumbs to death we are accustomed to look about us, to see how his work lives on. For JACOB REIGHARD of Michigan, who died in Ann Arbor on February 13, this is a confusing task: not that there is any difficulty in finding scientific organizations which he established, or lines of research in which he effectively pioneered, or students whom he trained and inspired; the difficulty lies in selecting, from the many that might be chosen, a living monument to his memory.

Reighard lives on in the Department of Zoology of the University of Michigan, which he built, during his long term of service (1886–1927), into a large and broad organization for teaching and research; in several of the zoology courses, which he taught with masterful skill; in the Museum of Zoology of the same university, of which he was Director from 1895 to 1913; in the university's great Biological Station, which he founded in 1909, and directed from 1909 to 1914; in the Research Club of the same institution, which he helped to organize in 1900; in the Michigan Academy of Science, which he conceived in the early nineties, and in the founding of which he played an important part; in the Great Lakes laboratory of the Bureau of Fisheries (now the Fish and Wildlife Service), which is the indirect product of his pioneering lake survey work of 1898 to 1901 and the direct development of researches done under his direction from 1917 to 1920; in the Institute for Fisheries Research of the Michigan Department of Conservation, which was the delayed outgrowth of the scientific work which he did for the Michigan Fish Commission from 1890 to 1895; and in several other organizations and societies.

Professor Reighard was a master and a pioneer in both pure and applied zoology. Each of the series of investigations which he carried out, like every other task which he undertook, was prosecuted with extreme thoroughness and completeness; with constant attention to detail, yet with the main objective in mind; with unfaltering logic, and penetrating insight; with originality and foresight.

The research fields which Professor Reighard cultivated were largely connected with ichthyology and the fisheries. He published particularly notable contributions on the embryology of fishes; on the limnology of the Great Lakes, as related to the production of food fish; on the breeding habits of fishes; on the behavior and psychology of fishes, particularly in connection with color discrimination; and on the theory and practice of fish culture. Any one of the series of contributions to ichthyology would have entitled Jacob Reighard to a place of honor in the field; together they have won for him a position of eminence.—CARL L. HUBBS and KARL F. LAGLER, *University of Michigan, Ann Arbor, Michigan.*

New York Aquarium

THE NEW YORK ZOOLOGICAL SOCIETY, according to a recent letter from the President, FAIRFIELD OSBORN, definitely intends to carry forward the scientific work of the AQUARIUM, and has made arrangements whereby the work of all of the scientific staff is being continued. DR. CHARLES M. BREDER and DR. MYRON GORDON are temporarily housed in space that has been generously loaned by the American Museum of Natural History. Quarters for the research work have been established for MR. C. W. COATES, Aquarist, and Dr. Ross Nigrelli, Pathologist, at the Zoological Park, where a considerable collection of fishes is now being maintained. The current researches cover a large number of detailed investigations, many of which are carried on in collaboration with research workers from such institutions as Yale University, New York University, American Museum of Natural History, U. S. Bureau of Fisheries, U. S. Customs Bureau, New York Department of Docks, Jewish Memorial Hospital, etc., and many of these associates use the Aquarium quarters intermittently as the progress of the studies demands.

Editorial Notes

THE editors were unable to get in touch with MR. MASLIN while this issue of COPEIA was in press. His article "Evidence for the Separation of the Crotalid Genera *Trimeresurus* and *Bothrops*, with a Key to the Genus *Trimeresurus*" (pp. 18–24) is consequently published without the author's revision.

Financial assistance in printing this issue of COPEIA was received from MR. HOWARD A. SCHUCK.

In COPEIA (3), 1941, page 180, line 23 (from the top), read S. C. for S. D.

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